The Milbank Memorial Fund

QUARTERLY

CONTENTS

Vol. XXXVIII JULY 1960 No. 3

Edited by the Technical Staff

Published quarterly by the MILBANK MEMORIAL FUND, 40 Wall Street, New York 5, New York. Printed in the U.S.A. Subscription $2.00, a year.

Entered as second-class matter at the Post Office at New York, N. Y., April 20, 1956, under the Act of March 8, 1879. Additional entry as second-class matter at the Post Office at Lancaster, Pa. Second Class postage paid at New York, N. Y. and Lancaster, Pa.

IN THIS ISSUE

In the search for causation of mental disorders and of other diseases, the relative role of heredity and environment has been debated for many years. Recently significant progress has been made in genetical research and the etiological relationship of hereditary factors to certain types of mental illness and mental deficiency has been demonstrated. In the article "Genetical Etiology in Mental Illness," Dr. Jan Böök, Director of the State Institute for Medical Genetics, Sweden, has summarized current knowledge on the role of genetics in mental disorders and has outlined some methodological problems in research concerned with evaluating genetical, environmental, and cultural variables in the occurrence of mental illness. This brief review emphasizes the limitations of previous investigations which have studied either the genetical variable or the social variables and directs attention to the need for integrated, multidimensional studies.

• • •

During the Korean War when nearly all young men aged 18 to 26 years were liable for military service, several million Selective Service registrants were evaluated and classified as to their qualifications for military service. An analysis of the causes of disqualification is reported in the article "Fitness of American Youth for Military Service" by Bernard D. Karpinos of the Medical Statistics Division, Office of the Surgeon General, Department of the Army. After adjustment of Selective Service data to take account of military enlistments and alternative services, the author finds that nearly one-fourth (23.6 per cent) of the liable manpower was disqualified on the basis of moral, mental, physical, or medical standards for military service. Eight per cent of the men were disqualified only be-

cause of failure to pass the mental test, 11 per cent because of physical or medical disability and 2 per cent were disqualified for both mental and medical reasons. In addition to the 24 per cent disqualified, 6 per cent were qualified but placed in Category C, a group with one or more physical defects and below average functional efficiency.

Prevalence rates for specific disqualifying defects among this population provide a valuable index of the health problems present at these young ages. The highest prevalence is found for conditions included in the general diagnostic category of diseases and defects of bones and organs of movement for which the prevalence rate is 23.3 per 1,000 examinees. The prevalence rates for psychiatric disorders and for diseases of the circulatory system were nearly as high, 22.7 and 20.0 per 1,000, respectively. Presence of an impairment which is cause for rejection for military service does not necessarily prevent the pursuit of a normal, civilian life, but many of these disqualified men have problems of occupational adjustment and need for special training as well as for health care.

• • •

Birth rates usually are highest in the late summer months and lowest in the spring, but the causes of this seasonal variation have not been established. In the article "Socio-Economic and Seasonal Variations in Birth Rates," by Benjamin Pasamanick, Simon Dinitz, and Hilda Knobloch, the monthly variation in birth rates is compared for different socio-economic groups in Baltimore. A strong inverse association is found; nonwhites and whites in the lowest socio-economic group had the greatest seasonal variation in birth rates and whites in the highest socio-economic group had little variation. The possible relation of climatic and nutritional factors to seasonal variation in births is discussed, and the potential significance of these factors to complications of pregnancy and infant morbidity is suggested.

• • •

A frequently noted feature of modern planned families is that the couples marry early and proceed to have the number

of children that they want fairly early in their married life. Thus if the couple have the two, three, or four children that they want by the time the wife is thirty, the couple usually find it necessary to seek protection against further pregnancies for a full decade or more. In his paper "Some Relationships Between Short Range and Long Range Risks of Unwanted Pregnancy," Dr. Robert G. Potter, Jr. is concerned with the level of contraceptive protection needed to avoid pregnancy after the family of desired size is accomplished.

• • •

The postwar decline in fertility of the Japanese has attracted the attention of demographers throughout the world. In her article "Continuities in the Declining Fertility of the Japanese," Dr. Irene B. Taeuber attempts to study this situation in historical and demographic setting. The analysis relates to changes in fertility from 1925 to 1955 and from 1951 to 1957, by prefectures, industrial grouping of prefectures, and rural and urban areas. Emphasis is placed on the trends of differentials in fertility and on changes in the relations of age and marital status to reproduction. "The net declines in fertility between 1925 and 1955 and the annual declines in recent years are quite consistent with expectations of declining fertility derived from experience elsewhere . . . The major unresolved problems . . . concern the timing of the declines, or, more specifically, the sequence of slow declines over a period of decades and then precipitant declines within a few years."

GENETICAL ETIOLOGY IN MENTAL ILLNESS[1]

JAN A. BÖÖK, M.D.[2]

IN this paper I do not intend to present a complete survey of genetically orientated psychiatric research from its beginning or during a specified period of time. I should like, rather, to stress a few general principles and, by way of a limited number of examples, bring out some of the pros and cons and weaknesses of the genetical argument. A comprehensive review was, in fact, published quite recently by Cowie and Slater [1].

Unfortunately, a great deal of contemporary psychiatry is based more on beliefs than on actual biological facts. Many psychiatrists even appear to discover "facts" that are actually inherent in their own hypothetical constructions. In other words, they forget the pieces that they had put into the bag and get enthusiastic when, at a later date, these same pieces are extracted through some cumbersome operation. This characteristic is, I think, true for many extreme and dogmatic schools of psychiatry, whether organic or psychodynamic, environmental or genetical. I do not, of course, think that I have the skill to master more than a few small corners of this intriguing field. However, my general medical and biological background together with my fragmentary experience of psychiatric research work has led to the tentative conclusion that any unitary explanation of the etiology even of what is now considered to be a special type of mental illness, or a clinical entity, will not contribute to the advancement of psychiatric research. It is true that most psychiatrists, at least theoretically, recognize a multidimensional etiology in almost every form of mental illness, but very often, in research as well as in practice, some variables are minimized or left out of consideration as universally constant.

[1] Paper given at a conference on the Epidemiology of Mental Disorder, held by the Milbank Memorial Fund, October, 1959. The proceedings will be published.

[2] Professor and Director, The Institute for Medical Genetics, University of Uppsala, Uppsala, Sweden.

It is well known to all biologists of man that man's evolution is unique as compared to other species insofar as it is regulated by an additional variable, namely culture, and not just by the usual two, *i.e.* heredity and environment. Culture, although part of our environment, has such a great importance in this context that it must be mentioned and thought of as a special, third variable.

It is rather natural to find that for centuries the explanation of mental illness, as well as for all kinds of human misery, was sought in environmental influences ranging from direct physical causes to witchcraft. Only relatively recently has there come understanding of the potentialities of genetical differences in creating individual variation.

Of the three variables, two, environment and culture, may and have been, studied extensively without regard to the third variable, heredity, although this is far from ideal. Genetic variables, however, cannot be extracted unless all the components of the variation are accounted for. In most of the common types of mental illness, *e.g.* the psychoses, there is one pattern of cultural variables, another of environmental and a third of genetical ones. Furthermore, when dealing with such complex problems the background, personality, and interests of the scientist is important. Yet little attention has been paid to the biases introduced by the personalities of those who carry out research in psychiatry. Considering all these difficulties one might easily take quite a pessimistic attitude as to the chances of getting anywhere at all. However, this is not justified. Practically all human diseases were once quite as mysterious as, for example, schizophrenia is today—perhaps even more so—but the advances in medical research are indisputable.

The possibilities for systematic research exist. We have highly trained and specialized research workers who can record and evaluate a vast number of variables belonging to the three groups; we have electronic computors to calculate any number of correlations in a short time; statisticians to deal with the meaningful interpretation of the figures, and so forth. The real

problem, of course, is to get all these fine skills to join forces. I imagine this would require the sacrifice of some personal prestige so that here again the personality of the scientist comes into the picture. Unless such systematic research in teams can be materialized, we will probably have to wait for the rare genius who can put his finger on the correct association without the aid of the electronic computor.

The point of my preceding argument is that unless we make an honest effort to understand what the other scientist is trying to do in psychiatric research, at least in essence, a lot of the meaningless argument about what is thought to be more or less important will continue. We should also remember that the present situation most likely is due to the discrepancy between the small number of established and generally accepted facts and the enormous demands placed upon our mental health programs.

After this introduction in which I have tried to place the general background, I should like to discuss a few principles of genetics as applied to medical research today.

Medical Genetics

An inquiry into the nature and significance of genetic variables in any disease is always legitimate. At first glance these variables may sometimes seem to be remote, as in malaria. Nevertheless it has now been shown that a specific gene, when it occurs alone, is associated with an increased resistance against this disease.[3] Thus both the individual reaction to the parasite as well as the epidemiology of the disease is influenced by this gene. In other so-called purely environmental diseases, while genetics may add little or nothing to the understanding or cure of the individual, it still may be significant from the epidemiological viewpoint. For example, our present knowledge of the associations between blood groups and disease indicates that few, if any, genes are entirely neutral from the standpoint of evolution. They may have positive or negative selective values for survival and propagation. "Negative" here does not imply

[3] In homozygous form the gene causes sickle cell anemia.

association with disease: in genetic terminology "fitness" is defined in terms of effective fertility. Nevertheless a great deal of this "negative fitness" carries epidemiological significance. I should like to stress this point because our group has been called together to discuss epidemiological issues with regard to mental illness. For if in many common and apparently environmental conditions we can afford to ignore genetics in the individual case, to do so in terms of populations might be a mistake.

In a strict sense medical genetics is concerned with diseases in which specific genes cause a major part of the variation. Its main targets in clinical research can be outlined schematically under the following four points.

a. *Identification of Genetic Diseases.* Special methods for family and twin research have been developed by which the causes of individual variation can be grouped into environmental and genetical components. The genetical components may be polygenic, *i.e.* due to many genes which combine freely and give continuous distributions (for example the genetical components of stature and intelligence). However, in human pathology it is more common that the genetical components consist of major or single gene differences which give rise to discontinuous distributions in families as well as in populations.

When it is said that specific genes are instrumental in a pathological condition, the statement is to be understood in the following way. Individuals who carry these genes in their chromosomes may or may not develop the disease depending on a variety of circumstances; those who do not possess these genes will under no circumstances get the specific condition. However, the latter may develop similar or seemingly identical conditions due to combinations of other genetical and environmental variables. While a discontinuous pattern in accordance with Mendelian laws indicates major gene differences, genetical homogeneity of a series of hospital index cases is as a rule questionable. This is especially true in psychiatry where our primitive type of diagnostic instruments require that we exercise great caution on this point.

b. *Epidemiology.* The two main facts to remember in genetical epidemiology is: (1) that the altered (mutated) gene is the agent and (2) that the human germ cell is the vector. In consequence of this, the mechanism of transmission is explained by gene distribution during meiosis and gene recombinations during fertilization; in other words by the Mendelian laws of heredity. Genes are transmitted from parents to children, only. Depending on the type of genes involved (homo- or heterozygous expression) or their location (*e.g.* in the sex chromosomes) different types of inheritance can be demonstrated. The usual way of dealing with such problems is by analysis of family data.

In a wider sense, genetical epidemiology deals with the behavior of gene mutations in larger groups of individuals *i.e.* whole populations—and their consequences for public health. The prevalence of genetical diseases is determined by such factors as: the frequency of new mutations; differential fertility of affected individuals; selective migration; and chance fluctuations of gene frequencies due to small family and population size (*i.e.* genetical drift).

c. *Mutation.* Genetical diseases are primarily due to altered "normal" genes, *i.e.* gene mutation or broadly speaking any kind of chemical or structural changes in the genetical material. Mutations may be caused by chemical or physical agents (induced mutations) or may occur for, as yet, unknown reasons. The most widely known examples are the mutations caused by ionizing radiations. Because mutations are random changes in genotypes which have gone through long periods of selection and adaptation the chances are that the vast majority of the changes will be non-adaptive, *i.e.* harmful or pathological. Investigations on the origin and fate of mutations in human populations are therefore essential to an understanding of the epidemiology of genetical diseases.

d. *Phenogenetics.* A most important issue is the study of the effect of specific gene mutations on the individuals who carry them in all their cells. In other words we ask the question "what does the gene do to this individual?" in the same sense

as the virologist inquires about the effect of a specific virus. Since genes act primarily on a biochemical or, if you like, biophysical, level (in most instances they are believed to regulate the synthesis of enzyme systems) all genetical diseases might rightly be called metabolic defects, or, in Garrod's nomenclature, "inborn errors of metabolism."

There are many lengthy pathways from these original intracellular metabolic defects to the symptoms and signs observed by the clinician or by the elaborated techniques of the laboratory scientist. Particularly in psychiatry, this field of biochemical genetics is largely unknown and invites fruitful exploration.

This concept of genetical diseases implies a spirit of reserved optimism, since in principle metabolic defects ought to be subject to attack by some sort of substitution therapy. Much pheno-genetical research is now carried out because of the important implications it may have on treatment.

Mental Deficiency

Since it has long been customary to deal separately with mental deficiency, psychoses and neuroses, I shall also use this classification though for no other than conventional reasons. While the problems of nomenclature cannot be taken up here, it should nevertheless be stressed that the only type of systematics acceptable from a scientific viewpoint would be based on explanatory etiology. If our existing nomenclatures are largely based on mental symptoms, and are therefore easy to criticize, it is because our ignorance makes it impossible at the present time to suggest major improvements.

The field of mental deficiency is a good example of the enormous diversity and complexity facing the psychiatrist. The use of genetical methods is just one of many approaches he can employ. We can, in fact, picture here some of the most brilliant contributions of genetics to psychiatry.

Mental deficency (oligophrenia) is subdivided into classes marked by different degrees of intellectual inferiority. These are, of course, social or psychological concepts and very poor

substitutes for medical diagnoses. Keeping this in mind, the present general consensus is that there are some types of mental deficiency which are polygenic and represent the tail end of the normal variation of intelligence. This is a quite reasonable explanation and genetical and statistical investigations of families and populations seem to support such a view [2]. As a problem it is a part of the wider question of the heritability of intelligence.

The conclusions about the genetical variables in determining intelligence, operationally defined as responses to specified tests, are based on biometrical analyses using correlations or regressions. As the interparental correlation is quite high, probably close to .50 (assortative mating) one would expect a parent-child and inter-sib correlation of .75 if the trait was due exclusively to polygenes without dominance or recessivity. Some actual correlations reported by different authors are given in Table 1.

The lower than expected figures indicate the considerable influence of environmental and cultural variables. A mathematical expression of the component parts of the variation is not possible. All the geneticist can say is that environmental changes such as social improvement, better education and so forth cannot be assumed to work on infinite plasticity. Just

Table 1. Correlation coefficients for intelligence.

Source	Type of Related Pairs		
	Parent-Child	Sib-Sib	Parent-Parent
Burt *et al.* (1911)	0.34	0.48	—
Thorndike (1928)	—	0.60	—
Willoughby (1928)	0.35	0.42	0.44
Jones (1928)	0.53	0.49	0.60
Herrmann *et al.* (1933)	—	0.32	—
Matthews *et al.* (1937)	—	0.30	—
Penrose (1938)	—	—	0.39
Cattell *et al.* (1938)	0.84	0.77	0.81
Roberts (1940)	—	0.54	—
Halperin (1945, 1946)	0.37	—	0.65

Source: Penrose, L. S.: The Biology of Mental Defect. London: Sidgwick and Jackson, 1954.

where, on the slope of the curve, pleasant physiological stupidity changes into social or medical problematics is a matter of conjecture. More important than such conjectures is the fact that the malignancy of inferior intelligence is a function of technical and social developments and public tolerance.

Turning to the pathological variations, I have suggested [3] the following main operational categories:

1. Genetical diseases with mental defect as an essential symptom.
2. Genetical diseases with mental defect as an occasional symptom.
3. Environmentally caused diseases, in which mental defect occurs as a symptom caused by either physical lesions (such as injuries, prematurity, infections), or by adverse mental mechanisms.

With respect to most patients with mental defect genetical studies have shown a significantly higher incidence of similar defects among close relatives. The etiological meaning of these findings is rather obscure and it would not be wise to use such figures for the calculation of predictions for further generations. It is now recognized that intellectual inferiority is too complex to be subjected to genetical analysis with any degree of efficiency. The possibilities for further advances in genetical studies will depend on more accurate and precise diagnoses and particularly on the finding of physical or biochemical correlates. Several conditions with such pathology have been shown to have a genetical etiology. Well known examples are the amaurotic idiocies, microcephaly, and phenylketonuria, all belonging to group 1 above.

The case of phenylketonuria is particularly instructive. When it was shown by Fölling [4] that some earlier unspecified patients with mental defect excreted phenylpyruvic acid in their urine, a foundation was laid for a more meaningful genetical investigation. It was soon demonstrated by Jervis [5] and others that the inability to transform phenylalanine to tyrosine and the associated mental defect was due to a single gene dif-

ference, the disease occurring in homozygotes. Later it has been shown that the majority of the heterozygous carriers can be identified by special phenylalanine tolerance tests [6].

Thus it has been possible by combined biochemical and genetical methodology to distinguish from the large group of "undifferentiated mental deficiency of unknown etiology" a condition which apparently is a clinical and genetical entity and to explain a great deal of its etiology.

A few other examples could be given but the story of phenylketonuria is sufficient to illustrate in principle how genetics can contribute to etiological research in this field and in clinical medicine.

The identification of juvenile amaurotic idiocy, on the other hand, was based on specific neurological, histological, and genetical evidence [7]. The advances in the biochemical genetics of this disease have been much slower. A recent development is that about 75 per cent of the heterozygotes can be identified by a characteristic lymphocyte morphology [8].

The identification of heterozygotes has been mentioned here not only because it is interesting and of practical importance for clinical genetics, but also because it gives considerable strength to the genetical argument in so-called recessive disorders.

Only one year ago the etiology of mongolism was a complete mystery in spite of the fact that for decades it has been one of the pet targets of psychiatrists and of many other physicians interested in mental defect. The big step towards the solution of this problem materialized not by the statistical type of genetics but by the development of human cell culture cytogenetics. French [9, 10], English [11] and Swedish [12] workers found that the somatic cells of these patients contained in their nuclei 47 chromosomes instead of the normal 46. The extra chromosome is one of the smallest ones and not the Y-chromosome. The findings demonstrate for the first time in man a type of genetical etiology well known in other organisms. The most likely explanation is that on some occasions egg cells or sperms with 24 instead of 23 chromosomes are produced

through a process known as non-disjunction. When fertilized with normal gametes they give rise to children with mongolism. At present some 20 cases have been examined cytogenetically and the results are consistent, but still it is too early to claim that all cases of mongolism are of this type. The interesting question as to whether other types of human pathology including mental defect may be due to chromosomal aberrations is at present being studied in our laboratories and elsewhere.

By briefly discussing polygenic variation, single gene differences, and chromosomal aberrations in relation to mental defect, I have tried to demonstrate how genetical research can profitably collaborate with other types of research concerned with environmental and cultural variables. The discussion has a general validity, the principles being equally true for other psychiatric fields and for clinical research as a whole. I have a strong feeling that, fortunately, the old argument of nature *versus* nurture has been put aside as an unprofitable quarrel and removed to the department of sophistical odds and ends. This should make it much easier for all of us to work together in collecting, correlating, analyzing, and interpreting biological and social facts in mental illness.

Psychoses

Genetical investigations have been concerned mainly with two of the so-called major psychoses, schizophrenia and manic-depressive psychosis. Inasmuch as many of these investigations, particularly in Scandinavia, have dealt with material derived from geographically limited populations, they have been at the same time epidemiological surveys of mental disorder so that all kinds of mental diseases were included. However, sufficient family data were gathered on only the most common diagnostic groups.

From a scientific viewpoint schizophrenic, manic-depressive, involutional, and senile psychoses, are equally poor diagnostic categories as categories of mental deficiency graded by intelligence or performance tests. Consequently what was said above

about the efficiency of genetical analyses based on mental symptoms is valid here, too. Yet in spite of these limitations, genetical studies have contributed significantly to the understanding of these psychoses. Even if this might still be denied by some psychiatrists the important facts about the distribution of psychoses in families and populations have been appreciated and recognized.

In using the terms "schizophrenia" or "manic-depressive psychosis" I do not imply that they are to be thought of as either clinical or genetical entities, since there are reasons to suspect that we are dealing with mental syndromes caused by a variety of different etiologies. Because the diagnoses are based exclusively on mental symptoms the field is open to a variety of interpretations more or less colored by the investigator's own ideas in respect to etiology. Caution must therefore be exerted in the interpretation of differences in incidence between different populations and investigators unless specifically stated that identical diagnostic principles have been used.

Schizophrenia. While the clinical picture will be modified by the cultural background, schizophrenic psychoses have been found in all kinds of human populations that have been thoroughly investigated, irrespective of whether they enjoy a high technical culture or not, e.g., in Bantus in Africa [13], in Chinese on Formosa [14], in the people of Thailand [15].

Schizophrenic psychoses occur in all social strata. There is, however, some evidence which suggests a statistical association between social disorganization and schizophrenic reactions. Hare [16] and Carstairs *et al.* [17] have shown that more hospital patients with this disease came from slums and lower social strata. Pasamanick *et al.* [18] also found an association between psychoses and low economic status. Other investigators [19, 20] failed to show such distributions. The precise significance of these findings (*cf.* also Harris *et al.* [21]) has not yet been worked out. Further studies are necessary to make possible an analysis of the complex interactions of cause and effect and of selective factors in different communities.

The epidemiological studies were initiated by genetically orientated psychiatrists in Germany early in this century. Later a number of Scandinavian geneticists and psychiatrists have made significant contributions (*cf.* Larsson and Sjögren [22]). Recently the interest in this field has spread to people more

Table 2. General morbid risk of schizophrenia.

Data Ascertained By	Corrected Population (Weinberg's Abridged Method)	Schizophrenia Morbid Risk Per Cent	Type of Population
I. Genealogic Random Test Method			
Several Authors Data Compiled by Fremming [39]	6,709	0.72 ± 0.10	Average. Mostly German Populations
II. Birth-Register Test			
Risk-Period 15–45 Yrs.			
Fremming [39]	3,777	0.90 ± 0.15	Bornholm, Denmark
III. Census Method			
Risk-Period 20–40 Yrs.			
Brugger [40]	18,312	0.38 ± 0.05	Thuringia, Germany
Strömgren [41]	429	0.47 ± 0.33	Rø, Bornholm, Denmark
Sjögren [42]	4,800	0.83 ± 0.13	West Swedish Island
Kaila [43]	194,000	0.91 ± 0.02[a]	Finland
Risk-Period 15–40 Yrs.			
Brugger [44]	2,894	0.41 ± 0.12	Allgäu, Germany
Brugger [45]	1,643	0.36 ± 0.15	Rosenheim, Germany
Sjögren [46]	4,390	0.68 ± 0.12	2 N. Swedish Isolates
Essen-Möller [36]	1,515	1.12 ± 0.27	South-Swedish Rural
Risk-Period 20–45 Yrs.			
Strömgren [41]	19,045	0.65 ± 0.05[b]	Bornholm, Denmark
Böök [26]	2,912	2.85 ± 0.31	N. Swedish Isolate
Risk-Period 15–45 Yrs.			
Schade [47]	1,929	0.52 ± 0.16	Schwalm, Germany
Sjögren [46]	3,440[c]	0.87 ± 0.16	2 N. Swedish Isolates
Böök [26]	3,467	2.39 ± 0.26	N. Swedish Isolate

Note: For comparison purposes differences in Risk Periods are not important.

[a] Does not include recovered cases. If these are taken into account, the morbid risk might be estimated at 1.15–1.20 per cent.

[b] With correction for excess mortality.

[c] Recalculated by the writer. Sjögren had no actual age distribution of this population but computed it according to the average Swedish rural population. As shown in this paper, the population of North Sweden differs somewhat insofar as the younger age groups are larger. This calculation was based on the assumption of the same age distribution as persisted in the investigation area in 1935 which probably gives a more correct morbid risk.

exclusively interested in the social and psychiatric aspects of the disease (*e.g.* Eaton and Weil [23], Mayer-Gross [24], Bremer [25], and others).

For genetical purposes it is convenient to compare the morbid risks calculated in different surveys. These figures express the total risk of becoming manifestly ill for all individuals who survive the period during which the disease may appear, roughly from 15 to 45 years of age. In a large number of surveys relatively small differences have been found, the average morbid risk being about 1 per cent (*cf.* Table 2). A notable exception is the figure of about 3 per cent found by Böök [26] in a North-Swedish community.

Support for a genetical etiology comes from a very large number of adequate studies on families and twins. As the results are very consistent there is no need to repeat individual details here. In short the morbid risk figures are: for siblings of schizophrenics, 7–15 per cent, for children of schizophrenics, 7–16 per cent and for parents of schizophrenics, 5–10 per cent. The figures for siblings and children are not significantly different if one compares families with one or no affected parent. Families with two affected parents have recently been studied by Elsässer [27] who calculated a risk of about 40 per cent for the children of such couples.

Attempts to show, by means of genetical-statistical methods, a significant heterogeneity in terms of the common subgroups (simplex, hebephrenic, catatonic, and paranoid forms) have so far been unsuccessful, possibly due to small numbers involved when the data are broken down.

Statistical associations between symptomatic groups among siblings have been reported by Schulz [28, 29], Bleuler [30] and Slater [31]. A striking symptomatic similarity was also found among the schizophrenics of my own North Swedish investigation [26]. This study was in fact planned to ensure a genetically more homogeneous material than the samples surveyed earlier. At present no definite conclusions can be drawn on the basis of these findings since such associations might

equally be due to regional or familial environmental influences. Also I think it would be hazardous to try to make genotypical divisions on the basis of psychological criteria.

Extensive twin studies by Kallmann [32, 33, 34] and Slater [35] have shown a concordance rate of 76 to 91 per cent for monozygotic and 10–17 per cent for dizygotic twins. In conjunction with the analysis of possible environmental causation, these results strongly support the view that genotypical variation is of primary importance for the development of schizophrenic psychoses.

The distribution of schizophrenia in families (collected by proper sampling techniques) can be explained, theoretically, by one or a combination of the following three mechanisms: (a) some sort of infection, (b) distinct physical or mental trauma and (c) genetical variation.

The first alternative has received no factual support and is rather improbable, unless one assumes some unknown virus which would only attack certain predisposed individuals. (This predisposition would then need to be genetically determined.)

The second alternative (physical or mental trauma) is a serious possibility and may occur in association with genetical predisposition. So far, however, proof is wanting. Severe stress situations during wartime, in concentration camps, etc., are not known to have resulted in an increase of schizophrenia. The influence of a particular family environment finds no support in the fact that in only a few families is a second sibling affected. To my knowledge there are no statistical investigations which support a pure psychogenetic theory of schizophrenia. On the other hand no definite proofs against this theory are available.

It is a common misunderstanding that genetical research has failed because no agreement has been reached as to the Mendelian mechanism of inheritance. While it is true that the crucial test must wait for further developments in diagnostic precision, nevertheless the most likely explanation appears to be that the schizophrenic psychoses are basically caused by major

gene differences which express themselves regularly in homozygotes and occasionally in heterozygotes. Since heterozygotes in this hypothesis are quite common this should imply that more psychotics are heterozygotes than homozygotes. The hypothesis of a simple recessive type of transmission does not agree with the data which show that no significant differences have been found between the risk figures for parents (when properly corrected, according to Essen-Möller [36]), siblings, and children with one or no affected parent. Recently Slater [37] has come to the same conclusion.

Any explanation has to include the assumption of what is commonly called "reduced penetrance," at least in heterozygotes. Penetrance is an operational and statistical concept and its nominal value is a function of diagnostic precision. The effect of practically all pathological human genes is subject to considerable modification or suppression by other genes, and environmental and cultural factors.

The concordance rates for monozygotic twins may be used to calculate a penetrance which, however, has another meaning than that based on family data. When a series of schizophrenic twins are collected by an investigator, naturally he is anxious that his *propositi* should raise as little doubt as possible regarding their diagnosis. So he selects "typical," e.g., often severe cases. These cases, in the present genetical hypothesis, may be assumed to belong to special entities with high penetrance or possess genetical modifiers to the same effect. Probably they are a mixture of both. As the monozygotic twin siblings carry identical genes the concordance rate and the derived penetrance will be higher than that calculated from family data. There are also a number of environmental mechanisms which work in the direction to increase the concordance for monozygotic twins, particularly when mental traits are considered. Consequently the high concordance rates for schizophrenic psychoses in monozygotic twins cannot be used as an argument against the tentative explanations given above.

The argument whether one or more pairs of genes are in-

volved will remain an open question. The point is that the distribution of schizophrenic individuals among the relatives of the *propositi* is presently best explained by postulating a major gene difference. The clear-cut difference between psychotic and non-psychotic siblings in the absence of known specific environmental causation is in favor of this interpretation.

It is unlikely that the high morbid risk of 3 per cent in the North Swedish area [26] is associated with general local environmental factors as no risk increase was found for the different categories of relatives of the *propositi*. The findings are best explained as an effect of selective immigration, genetical drift or both.

As in other genetical diseases, the schizophrenic psychoses cannot be caused exclusively by major gene differences. The effect of such genes is modified by other genes and, of course, by so far unspecified environmental factors. The important conclusion which I think is quite justified, is that major gene differences are very likely the basic prerequisites for the initiation of a chain of events which may result in a psychosis. Unless this specific genetical prerequisite exists the illness will not occur, provided we are not dealing with a supposedly rare non-genetical schizophrenic syndrome.

Such a working hypothesis implies an interesting biological basis for further research. With the traditional genetical statistical methods applied to the psychopathological traits we have probably already extracted all useful information. The next step should be to concentrate on approaches which appear suitable for studying somatic and biochemical correlates and subject these to genetical tests.

Whatever may be the final answer to the problem of genetical factors in schizophrenic psychoses there remains no doubt that psychological and social studies are as important as genetical ones. It seems clear that all genetical studies carried out so far have been more or less deficient in special techniques of environmental and interpersonal analysis. In a corresponding way most environmental, and especially psychological studies, have been

deficient in statistical techniques and an understanding of human biology.

Manic-depressive Psychosis. A discussion of this syndrome would follow very closely the same general scheme as outlined for schizophrenia. I will therefore restrict myself to a few remarks. The morbid risks among close relatives of manic-depressive psychotics do not differ significantly from those of schizophrenics. All recent European investigations agree on risks of 10–15 per cent for parents, siblings, and children. Kallmann's figures [32, 33, 34] deviate upwards by some additional 10 per cent in all instances. What exactly this implies must await the publication of his case histories since they may only demonstrate Dr. Kallmann's diagnostic latitude. Nevertheless, for reasons already given above, such figures cannot be expected to be crucial to the genetical argument.

An important finding in all large genetical investigations [38, 34] is that schizophrenic psychoses do not occur with an increased frequency among the relatives of manic-depressive *propositi* and *vice versa.* This fact indicates significant biological differences between the two syndromes.

The question of the heritability of the two major psychotic syndromes is worthy of serious consideration. It carries great importance not only for the problems of etiology and treatment but also for epidemiology. There is one aspect of epidemiology that has only been touched upon and I should like to return to it here. Mental illnesses in which genetical factors are significantly involved, or are strongly suspected to be so, are quite common. We might assume a general morbid risk of at least 2 per cent. There is a very real possibility that the general increase of the mutation rate due to ionizing radiations and chemical mutagens will cause a significant increase in mental illnesses.

In conclusion, I should like to summarize as follows. A crucial proof of genetical etiology is impossible without a diagnostic method that identifies an almost one to one relationship with the causative gene mutation. This is the case in illnesses as phenylketonuria and amaurotic idiocy which have been men-

tioned as examples. In other conditions which are still identifiable in terms of mental symptoms only, no decision is possible. Here the geneticist and his co-workers must proceed to test different biological correlates. The repetition of traditional family and population surveys, although they surely contribute to epidemiology, will never enable the geneticist to prove his case definitely. While genetical studies of the major mental syndromes—schizophrenia and manic-depressive psychosis—have been justified up to the point indicated here, I find the diagnostic difficulties in the field of neuroses to be of such magnitude as to make a genetical approach, while perhaps interesting, definitely not very meaningful.

References

1. Cowie, V. and Slater, E.: Psychiatric Genetics. *In* Recent Progress in Psychiatry. London: J. and A. Churchill, 1959, 3, p. 1.

2. Roberts, J. A. F.: The Genetics of Mental Deficiency. *Eugenics Review*, 1952, 44, p. 71.

3. Böök, J. A.: Oligophrenia. *In* Sorsby, A. (Ed.): Clinical Genetics. London: Butterworth, 1953, p. 322.

4. Fölling, A.: Uber Ausscheidung von Phenylbrenztraubensäure in den Harn als Stoffwechselanomalie in Verbindung mit Imbecillität. *Hoppe-Seylers Zeitschrift für physiologische Chemie*, 1934, 227, p. 169.

5. Jervis, G. A.: The Genetics of Phenylpyruvic Oligophrenia. *Journal of Mental Science*, 1939, 85, p. 719.

6. Hsia, D. Y. Y. *et al.*: Detection by Phenylalanine Tolerance Tests of Heterozygous Carriers of Phenylketonuria. *Nature*, 1956, 178, p. 1239.

7. Sjögren, T.: Die Juvenile Amaurotische Idiotie. *Hereditas*, 1931, 14, p. 197.

8. Böök, J. A. and Rayner, S.: Genetics and Blood Morphology in Amaurotic Idiocy. *Lancet*, 1958, 1, p. 1077.

9. Lejeune, J. *et al.*: Les Chromosomes Humains en Culture de Tissus. *Les Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, 1959, 248, p. 602.

10. Lejeune, J. *et al.*: Étude des Chromosomes Somatiques de Neuf Enfants Mongoliens. *Les Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, 1959, 248, p. 1721.

11. Jacobs, P. A. *et al.*: The Somatic Chromosomes in Mongolism. *Lancet*, 1959, 1, p. 710.

12. Böök, J. A. *et al.*: Cytogenetical Observations in Mongolism. *Acta paediatrica*, 1959, 48, p. 121.

13. Moffson, A.: Schizophrenia in Male Bantu Admissions to Weskoppies Hospital. *South African Medical Journal*, 1954, 28, p. 662.

14. Lin, Tsung-yi: A Study of the Incidence of Mental Disorder in Chinese and Other Cultures. *Psychiatry*, 1953, 16, p. 313.

15. Prasop, R.: Studies of Mental Illness in Thailand. Bangkok: Phyathai, 1957.

16. Hare, E. H.: Mental Illness and Social Class in Bristol. *British Journal of Preventive and Social Medicine*, 1955, 9, p. 191.

17. Carstairs, G. M. *et al.:* Changing Population of Mental Hospitals. *British Journal of Preventive and Social Medicine*, 1955, 9, p. 187.

18. Pasamanick, B. *et al.:* Mental Disease Prevalence in an Urban Population. *Public Health Reports*, 1957, 72, p. 574.

19. Clausen, J. A. and Kohn, M. L.: Schizophrenia and the Social Structure of a Small City. *Public Health Reports*, 1957, 72, p. 578.

20. Essen-Möller, E.: Individual Traits and Morbidity in a Swedish Rural Population. *Acta psychiatrica et neurologica.* Supplementum 100, 1956.

21. Harris, A. *et al.:* Schizophrenia: A Prognostic and Social Study. *British Journal of Preventive and Social Medicine*, 1956, 10, p. 107.

22. Larsson, T. and Sjögren, T.: A Methodological, Psychiatric and Statistical Study of a Large Swedish Rural Population. *Acta psychiatrica et neurologica scandinavica.* Supplementum 89, 1954.

23. Eaton, J. W. and Weil, R. J.: Culture and Mental Disorder. Glencoe, Illinois: The Free Press, 1955.

24. Mayer-Gross, W.: Mental Health Survey in a Rural Area. *Eugenics Review*, 1948, 40, p. 140.

25. Bremer, J.: A Social Psychiatric Investigation of a Small Community in Northern Norway. *Acta psychiatrica et neurologica scandinavica.* Supplementum 62, 1951.

26. Böök, J. A.: A Genetic and Neuropsychiatric Investigation of a North Swedish Population, with Special Regard to Schizophrenia and Mental Deficiency. *Acta Genetica et Statistica Medica*, 1953, 4, pp. 1, 133, and 345.

27. Elsässer, G.: Die Nachkommen Geisteskranker Elternpaare. Stuttgart: Georg Thieme, 1952.

28. Schulz, B.: Zur Erbpathologie der Schizophrenie. *Zeitschrift für die Gesamte Neurologie und Psychiatrie*, 1932, 143, p. 175.

29. Schulz, B.: Versuch einer genealogisch-statistischen Ueberprüfung eines Schizophreniematerials auf biologische Einheitlichkeit. *Zeitschrift für die Gesamte Neurologie und Psychiatrie*, 1934, 151, p. 145.

30. Bleuler, M.: Krankheitsverlauf, Persönlichkeit und Verwandtschaft Schizophrener und ihre gegenseitigen Beziehungen. *In* Bostroem, A. and Beringer, M. (Eds.). Sammlung Psychiatrischer und Neurologischer Einzeldarstellungen. Leipzig: Georg Thieme, 1940.

31. Slater, E.: Genetical Causes of Schizophrenic Symptoms. *Monatsschrift für Psychiatrie und Neurologie*, 1947, 113, p. 50.

32. Kallmann, F. J.: The Genetic Theory of Schizophrenia. An Analysis of 691 Twin Index Families. *American Journal of Psychiatry*, 1946, 103, p. 309.

33. Kallmann, F. J.: The Genetics of Psychoses. *In* Congrès Internationale de Psychiatrie. vi: Psychiatrie Sociale. Paris: Hermann, 1950.

34. Kallmann, F. J.: Heredity in Health and Mental Disorder. New York: W. W. Norton, 1953.

35. Slater, E. and Shields, J.: Psychotic and Neurotic Illnesses in Twins. Medical Research Council, Special Report Series No. 278. London: Her Majesty's Stationery Office, 1953.

36. Essen-Möller, E.: The Calculation of Morbid Risk in Parents of Index Cases as Applied to a Family Sample of Schizophrenics. *Acta Genetica et Statistica Medica,* 1955, 5, p. 334.

37. Slater, E.: The Monogenic Theory of Schizophrenia. *Acta Genetica et Statistica Medica,* 1958, 8, p. 50.

38. Stenstedt, A.: A Study in Manic-Depressive Psychosis. *Acta psychiatrica et neurologica scandinavica.* Supplementum 79, 1952.

39. Fremming, K.: Sygdomsrisikoen for Sindslidelser. [Morbid Risk of Mental Diseases and Other Mental Abnormalities in an Average Danish Population.] Copenhagen: Einar Munksgaard, 1947.

40. Brugger, C.: Versuch einer Geisteskrankenzählung in Thüringen. *Zeitschrift für die gesamte Neurologie et Psychiatrie,* 1931, 133, p. 352.

41. Strömgren, E.: Beiträge zur psychiatrischen Erblehre. *Acta psychiatrica et neurologica.* Supplementum 19, 1938.

42. Sjögren, T.: Genetic-Statistical and Psychiatric Investigations of a West Swedish Population. *Acta psychiatrica et neurologica scandinavica.* Supplementum 52, 1948.

43. Kaila, M.: Ueber die Durchschnittshäufigkeit der Geisteskrankheiten und des Schwachsinns in Finnland. *Acta psychiatrica et neurologica,* 1942, 17, p. 47.

44. Brugger, C.: Psychiatrische Ergebnisse einer medizinischen, anthropologischen und soziologischen Bevölkerungsuntersuchung. *Zeitschrift für die gesamte Neurologie et Psychiatrie,* 1933, 146, p. 489.

45. Brugger, C.: Psychiatrische Bestandesaufnahme im Gebiet eines medizinisch-anthropologischen Zensus in der Nähe von Rosenheim. *Zeitschrift für die gesamte Neurologie et Psychiatrie,* 1938, 156, p. 189.

46. Sjögren, T.: Investigations of the Heredity of Psychoses and Mental Deficiency in Two North Swedish Parishes. *Annals of Eugenics,* 1935, 6, p. 253.

47. Schade, H.: Ergebnisse einer Bevölkerungsuntersuchung in der Schwalm. *Akademie der Wissenschaften und der Literatur. Abhandlungen der Mathematisch-Naturwissenschaftlichen Klassen,* 1950, 16, p. 419.

FITNESS OF AMERICAN YOUTH FOR MILITARY SERVICE

BERNARD D. KARPINOS[1]

THE present analysis on the fitness of American youth for military service is based on the Korean War experience, comprising the period from July 1950 through July 1953. Three fundamental criteria—moral, mental, and medical, determine the individual's fitness for military service. These criteria, or "standards of acceptability," are promulgated in special regulations of the Armed Forces. In addition, the statutory provisions, which establish the general liability of men for military service and the broader aspects of the standards, are likewise essential factors in the selection and appraisal of youth for military service. The statutory provisions and the standards of acceptability, therefore, are briefly stated, as far as they are relevant to the analysis.

MILITARY LIABILITY

The liability of men for military service is fixed by Acts of Congress. For this period, the military liability was initially set-forth in the "Extension Act of 1950" (Public Law 599, 81st Congress) enacted in June 1950—an extension of the 1948 Selective Service Act (Public Law 759, 80th Congress). Except for certain exempt individuals, the Act required that every male citizen of the United States and every male noncitizen residing in the United States, within the age limits of 18 and 26, register with his local board.[2] The initial registration began on 30 August 1948 and continued through 18 September

[1] From the Medical Statistics Division, Office of the Surgeon General, Department of the Army.

[2] The following individuals have been exempted by the Acts from registration: foreign diplomatic representatives, technical attaches of foreign embassies and legations, consuls generals, consuls, vice consuls, and other consular agents of foreign countries who are not citizens of the United States. Individuals who, at the time of registration, are on active duty with the Armed Forces and those serving in the Coast Guard, Geodetic Survey, and Public Health Service are also exempt from registration; however, these individuals have to register upon completion of service.

of that year. It has been supplemented since then by continuous registration of those who attain 18 years of age. Under this Act, all registrants became immediately liable for military service, exclusive of the 18-year olds whose liability did not become effective until they reached age 19.

The 1950 Extension Act, which remained in effect until June 1951, was replaced by the "Universal Military Training and Service Act" (UMT&S Act, Public Law 51, 82nd Congress). The basic provisions of the preceding Acts remained intact; however, the former minimum age of liability for service was lowered from 19 to 18½ years of age. Furthermore, 17-year olds could volunteer for induction if they had a written consent from their parent(s) or guardian(s). (Of course, 17-year olds could volunteer for enlistment even before this Act was passed.)

Theoretically, each registrant liable for military service is regarded as available for such service (class I-A), until his eligibility for deferment or exemption is established. The exempt or deferred classes comprise registrants in certain essential non-agricultural and agricultural occupations—in the interest of the civilian economy; ministers of religion, or divinity students; officials deferred by law; postponed students; those deferred or exempted because of personal or family hardship, etc. Such registrants are removed from the I-A classification (1).

A registrant could discharge his military liability in several ways. He could voluntarily enlist into the Armed Forces; join the National Guard, ROTC, or other reserve units (even before he reached the age of registration); or he could wait until "drafted." The last-mentioned choice, referred to as "processing for induction," involves local board prescreening and a preinduction and induction examination at an induction station.

Available Data

Comprehensive data with respect to qualification of registrants for military service are available only with respect to those processed for induction; particularly, data related to the

preinduction and induction results (2–6). The commonly quoted disqualification data for military service relate to this segment of the total liable manpower pool. However, the fact that many youths enter the Armed Forces through channels other than induction has an important bearing on these disqualifications, as shown later. (The Navy and the Air Force fulfilled their manpower needs exclusively through enlistments and other reserve programs; the Marine Corps utilized inductions to a very limited extent, depending primarily on enlistments; the Army depended principally on inductions.)

Obviously, in order to arrive at a valid measure of fitness of youth, all segments of the liable manpower pool are to be considered (7). The basic data utilized toward this end are those dealing with registrants processed for induction, but adjusted to reflect the total liable manpower pool.

Standards of Acceptability

As stated, individuals examined for military service are evaluated from moral, mental, and medical (physical and psychiatric) standpoint. Briefly, the basic evaluative standards are as follows.

Moral Standards. According to Army regulations, the following individuals are not acceptable for military service for moral reasons: (a) Those having certain criminal records; (b) those exhibiting criminal tendencies, demonstrated by frequent difficulties with law enforcement agencies; or antisocial tendencies, involving alcoholism, drug addiction, or other traits of character rendering them unfit to associate with military personnel; and (c) those who have been previously separated from the Armed Forces under conditions other than honorable, or for the good of the service (8). Individuals disqualified for military service for moral reasons are classified as "administrative" disqualifications. (These disqualifications include negligible numbers of individuals forwarded erroneously for examination.)

Mental Standards. For evaluating the examinee's mental

qualification for military service, the Armed Forces Qualification Tests (AFQT) have been used. These mental tests are the result of the joint efforts of all military services. Initially, AFQT 1 or 2 were applied. These equivalent versions of the test consisted of 90 questions, equally divided among items of the following content areas: vocabulary, arithmetic, and spatial relationship. In 1953, they were replaced by AFQT 3 and 4 which added a fourth content area, designed to test the examinee's mechanical ability. The later tests consisted of 100 questions equally divided among their four content areas.

It is a spiral omnibus type of test, that is, the test is arranged in cycles of increasing difficulty, and each cycle contains an equal number of questions of comparable levels of difficulty in each content area. AFQT 1 and 2 consisted of three cycles containing six questions plus four cycles with three questions; AFQT 3 and 4 consisted of three cycles with four questions; three cycles with three questions, and two cycles with two questions—in each of the content areas.

With the introduction of the AFQT 3 and 4, the formula for scoring the test was modified. Formerly, the score was based on the number of questions answered correctly. To compensate for potential correct guessing, the new formula provided for subtracting a fraction (one-third) of the number of questions answered wrong from the number of questions answered right. Omitted questions are not counted.

The test was administered to each registrant forwarded for examination, irrespective of his educational attainment. The passing score, based on multiple choice answers, varied during the Korean War period. From July 1950 to July 1951, the minimum requirement, regardless of the type of items answered successfully, was equivalent to 39 correct answers on AFQT 1 and 2; from July 1951 through December 1951 the minimum was equivalent to 34 correct answers; from December 1951, the passing score was established by the 1951 UMT&S Act as 10 percentile, equivalent to 27 correct answers on AFQT 1 and 2, and 25 correct answers on the AFQT 3 and 4.

Since AFQT 3 and 4 were in effect only during the last seven months of the period under study, the disqualifications for mental reasons during the Korean War period reflect mainly failures to meet the 10 percentile requirement on AFQT 1 and 2. (Examinees who failed the mental test prior to January 1952 were reexamined during 1952 on the basis of the minimum established by the 1951 UMT&S Act.) The minimum requirement was devised to have the effect of eliminating 10 per cent of the total male population of the lowest aptitude.

Operationally, the test was to fulfill a dual function: (a) To measure the examinee's ability to absorb military training within reasonable limit of time, in order to eliminate those who do not possess such ability, and (b) to provide a uniform measure of the general usefulness for the service of those who qualified on the test. On the basis of their scores on the AFQT, the examinees are divided into the following five mental groups representing a regressive range in mental ability, from very rapid learners (Group I) to very slow learners (Group V):

Mental Group	*Percentile Score*	*Equivalent Correct Answers*	
		AFQT 1 and 2	*AFQT 3 and 4**
I	93–100	81–90	89–100
II	65– 92	65–80	74– 88
III	31– 64	47–64	53– 73
IV	10– 30	27–46	25– 52
V	9 and Below	1–26	1– 24

Examinees classified as mental group V are regarded as mental test failures. However, a "terminal screening" has been prescribed for those whose educational or occupational background indicate that they should not have failed the test. If the findings are in variance with their score attained on the

* The number of correct answers on these versions of the test is computed by subtracting from the number of correct answers one-third of the number of wrong answers. (See text.)

mental test, the examinees are declared as "administrative acceptees."

The mental test results bear no direct relationship to such concepts as "IQ" (intelligence quotient), or "MA" (mental age). They are not to be interpreted, therefore, in terms of those concepts. (For details on the structure and development of the test, its history and standards, *see* (8–15); for the results of the mental testing by year and state, *see* (2–6).)

Medical Standards. Congress provided under the 1951 UMT&S Act that the minimum standards of physical acceptability shall not be higher than those which were applied in World War II (since January 1945) to persons between the ages 18 and 26. Actually, changes were introduced after World War II that led toward lower medical requirements. Foremost was the change in policy with respect to psychiatric standards, which resulted during World War II in a large number of disqualifications for medical reasons. A series of follow-up studies on psychiatric cases within the Army brought about a growing recognition that the psychiatric standards of World War II were obviously overcautious and hence caused a considerable loss of potential military manpower. The present underlying working hypothesis has been that greater proficiency can be accomplished in identifying individuals with psychiatric difficulties when they are observed while living under military conditions, rather than at the time of their examination. As a result, psychoneurosis of any degree is now considered acceptable, if it has not incapacitated the individual in civilian life; also, history of transient psychotic reactions is considered acceptable, if the individual has otherwise clearly demonstrated stability. Only a coarse psychiatric screening for the purpose of eliminating gross psychiatric conditions has been employed at the examining stations.

The medical standards were lowered since World War II in regard to perforated eardrums and moderate deformities of the extremities which were previously disqualifying. Furthermore, the concept of "successful treatment" was introduced in

evaluating certain defects and diseases which were formerly considered unacceptable. Though these changes may be regarded as fundamental to the particular diagnoses, they are of little significance from the overall standpoint of manpower procurement, because of the small number of individuals involved in such cases.

An important change, though indirectly connected with medical standards, was the elimination of the "limited service" classification. Persons so classified in World War II were at various times either not inducted at all, inducted on a quota basis (usually 5 per cent of all inductees), or had their eligibility for induction restricted by certain additional educational or occupational requirements, not applicable to other registrants. The term "limited service" is no longer in use; such registrants are now ordinarily classified as Physical Category C, acceptable without any quantitative restrictions (16–23).

Examination Procedures

The examination procedures for registrants processed for induction have been essentially the same as in World War II (since 1944). After a certain preliminary screening by the local boards, discussed in subsequent section, registrants classified as available for military service (I-A) are forwarded to the examining stations, ordinarily for a preinduction examination. Only the acceptability of the examinee for military service is determined on this examination.

Registrants found acceptable for military service on the preinduction examination are subsequently ordered to report for induction, but in not less than 21 days after their preinduction examination. At the time of induction such resgistrants ordinarily undergo only a medical check-up ("physical inspection") for any diseases or injuries that could have been incurred since their preinduction examination. However, if more than 120 days have elapsed since their preinduction examination, these examinees are given a complete medical examination due to "lapse of time." In some instances, registrants are for-

warded for induction without a preinduction examination ("direct induction"). In these cases, the registrant is completely examined from a moral, mental and medical viewpoint, as on a preinduction examination.

Until September 1951, both the preinduction and induction examinations were accomplished at the "Joint Examining and Induction Stations." Since that date, this function has been performed by the "Armed Forces Examining Station" (AFES). The term "induction stations" will be used in referring to both the "Joint Examining and Induction Stations" and the AFES.

Preinduction and Induction Examination Results

Preinduction Examination Results. 3.7 million Selective Service registrants underwent a preinduction examination during the Korean War. Evaluated in terms of the prevailing moral, mental, and medical standards, 2.5 million of the examined registrants (67.8 per cent) were found acceptable, and 1.2 million (32.2 per cent) were disqualified. The reasons for

Table 1. Results of preinduction examinations, Korean War (July 1950 through July 1953).[1]

Result of Examination	All Examined Registrants[2]		Not-Previously Examined Registrants	
	Number (1)	Per Cent (2)	Number (3)	Per Cent (4)
Examined	3,685,293	100.0	3,492,308	100.0
Found Acceptable	2,496,683	67.8	2,380,610	68.2
Disqualified	1,188,610	32.2	1,111,698	31.8
Administrative Reasons	30,633	0.8	27,550	0.8
Failed Mental Test, Only	488,848	13.3	465,849	13.3
Failed Mental Test and Medically Disqualified	119,045	3.2	113,581	3.3
Medical Reasons, Only	550,084	14.9	504,718	14.4

[1] The data were corrected for registrants who were disqualified prior to January 1952 for failing the mental tests and later reexamined and found acceptable under modified mental testing procedures.

[2] These data include both not-previously and previously examined registrants.

Source: "Summary of Registrant Examinations for Induction," DA Form 316 (Reports Control Symbol MED-66).

the disqualifications were: 0.8 per cent, administrative (nearly, all moral); 13.3 per cent, mental (failure to pass the required mental test), only; 3.2 per cent, combined mental and medical; and 14.9 per cent, medical, only (Table 1, Columns 1 and 2). (Analogous data by year and state are published in (2–6).)

These examinees include registrants forwarded by the local boards for a preinduction examination for the first time ("not-previously" examined) and reexaminees, namely, registrants who had been previously examined and disqualified. Even though the disqualification rates of all examined registrants were about the same as those of the not-previously examined registrants alone (compare Columns 2 and 4, Table 1), it is obviously more appropriate for a more precise evaluation to confine the analysis to the latter examinees.

3.5 million registrants were given a preinduction examination during this period for the first time. The total disqualification rate of these examinees was 31.8 per cent, distributed as follows by disqualifying cause: 0.8 per cent, administrative reasons; 13.3 per cent, mental reasons, only; 3.3 per cent, combined mental and medical reasons; and 14.4 per cent, medical reasons only (Table 1, Columns 3 and 4).

The Korean War experience thus indicates that 16.6 per cent (13.3 per cent plus 3.3 per cent) of the registrants who were given a preinduction examination could not pass the mental test; 17.7 per cent (14.4 per cent plus 3.3 per cent) could not meet the medical standards.

Induction Examination Results. In response to the monthly calls for inductees by the Department of Defense, 1.6 million registrants were forwarded by the local boards during this period for induction (Table 2, Column 1). Except for some 8 per cent (127,000 registrants), who were forwarded for "direct induction" (without preinduction examination), these were registrants who had qualified on preinduction examination. Of the latter examinees (Table 2, Column 3) 1,371,000 were given a physical inspection and some 142,000 examinees underwent a complete medical examination due to "lapse of time."

As indicated in Table 2 (Column 4), 2.7 per cent of the examinees, who had qualified on preinduction examination, were disqualified at the time of induction, primarily for medical reasons. These additional disqualifications represent the final results of those who were examined at the induction stations. Therefore, they were taken into account in this general analysis, as explained later.

Of the total number of registrants who were inducted during this period (Table 2, Column 1), 1,473,000 were assigned to the Army, and 85,000 to the Marine Corps. No inductees were allocated during this period to the Navy or the Air Force, as they had met their manpower needs through enlistments and reserve programs.

Local Board Screening

Although the determination of acceptability for military serv-

Table 2. Results of inspection and induction examinations, Korean War (August 1950 through July 1953).

Results of Examination	Inspection and Induction Examinations, Total[1]		Physical Inspection or Complete Medical Examination[2]	
	Number (1)	Per Cent (2)	Number (3)	Per Cent (4)
Total Examined	1,639,721	100.0	1,512,825	100.0
Inducted	1,557,948	95.0	1,471,443	97.3
Disqualified	81,773	5.0	41,382	2.7
Administrative Reasons	11,398	0.7	10,383	0.7
Failed Mental Test, Only	18,097	1.1	—	—
Failed Mental Test and Medically Disqualified	2,955	0.2	—	—
Medical Reasons, Only	49,323	3.0	30,999	2.0

[1] Refers to registrants who qualified on preinduction examination, as well as registrants forwarded for "direct" induction, without a preinduction examination, e.g., volunteers, delinquents, parolees, etc.

[2] Includes registrants, qualified on preinduction examination, who were given a physical inspection and those who have undergone a required complete medical examination (instead of a physical inspection) at the time of induction because of "lapse of time" (more than 120 days since their preinduction examination).

Source: "Summary of Registrant Examinations for Induction," DA Form 316 (Reports Control Symbol MED-66).

ice is primarily a function of the induction stations, considerable number of registrants, classified as available for service (I-A), are screened out by the local board without being referred to the induction stations. Those disqualified by the local boards are registrants found morally unfit, as previously defined and registrants with manifestly disqualifying defects (25).

It has been determined that out of 1,000 registrants available for service (I-A), 68 were disqualified by the local boards during this period: 30 for administrative (moral) reasons; 3 for mental reasons, though no provision was made for such disqualifications by the local boards; and 35 for manifestly disqualifying defects (Table 3, Column 1). (*See* "Appendix, Technical Notes," Section I, for the derivation of these rates.)

Combined Results of Examination of Registrants for Induction

From the separate analyses of the disqualifications at the

Table 3. Combined disqualification rates of selective service registrants processed for induction and overall disqualification rate, by disqualifying cause, Korean War (July 1950 through July 1953).[1]

Disqualifying Cause	Combined Disqualification Rates Per 1,000 Registrants Processed for Induction				Overall Disqualification Rates Per 1,000 Youths[2]
	Local Board Screening	Preinduction or Direct Induction[2]	Induction	Total	
	(1)	(2)	(3)	(4)	(5)
Administrative	30.2	7.4	4.4	42.0	25.9
Failed Mental Test, Only	3.2[3]	124.2	--	127.4	78.7
Failed Mental Test and Medically Disqualified	—	30.3	—	30.3	18.7
Medical, Only	35.2	134.6	13.0	182.8	112.9
Total	68.6	296.5	17.4	382.5	236.2

[1] For the derivation of the data given in this table, see "Appendix: Technical Notes."
[2] "Direct Induction" refers to registrants inducted without a preinduction examination, e.g., volunteers, delinquents, etc.
[3] Data in Column 4, adjusted for sources of procurement, outside induction; e.g., enlistments, National Guard, ROTC, and other reserve programs.
[3] There was no provision for mental testing at the local boards. However, some local boards disqualified illiterates, as well as registrants who, they thought, will not be able to pass the Armed Forces mental test.

local boards, at the induction stations at the time of preinduction or direct induction, and at the induction stations at the time of induction, the following combined results of the examinations were derived: Out of 1,000 registrants available for service (I-A), 618 qualified and 382 were disqualified for military service. The latter registrants are distributed as follows by disqualifying cause: 42, administrative reasons; 127, mental reasons, only; 30, mental and medical reasons; and 183 medical reasons, only (Table 3, Column 4).

Thus, out of 1,000 registrants processed in the Korean War for induction, 158 (128 plus 30) could not pass the mental test; 213 (183 plus 30) could not meet the medical standards. (*See* "Appendix, Technical Notes," Section II, for computation of the combined results.)

No adjustment was made thus far in these data for enlistments and related sources of manpower procurement, apart from inductions.

Overall Disqualification Rates of Youth for Military Service

It has been previously indicated that a large proportion of individuals enter military service prior to being processed through the Selective Service system for induction. The prevailing procedures were that individuals who applied, but could not qualify for enlistment or for the other procurement programs (outside inductions), were continued as I-A (available for service) in the Selective Service system. As a result, the registrants processed for induction were disproportionally "weighted" by those who were disqualified under the other procurement programs, inflating hence the disqualification rates of the former group.

It has been established that 38 per cent of the liable manpower pool fulfilled their liability for military service during the Korean War through channels other than induction. The disqualification data (Table 3, Column 4), adjusted for these other sources of manpower procurement, are shown in Table 3, Column 5.

The adjusted data indicate that 23.6 per cent of the youths (236 out of 1,000 youths) could not qualify for military service during the Korean War under the prevailing moral, mental, and medical standards. (For the manner in which the data were adjusted, *see* "Appendix, Technical Notes," Section III.)

Physical Categories of Youths Qualified for Military Service

Certain medical defects found at the time of examination are not considered disqualifying for military service. Such defects, however, are likely to impose certain functional limitations with respect to job assignments in the military service. (They are referred to as "limiting defects.") The registrant's functional capacity is currently assessed in terms of PULHES factors symbolizing the following:

P—Physical capacity or stamina: General physical capacity or stamina, and organic defects or diseases which affect general physical capacity and which do not fall under the other specific factors of the profile system.

U—Upper extremities: Functional use of hands, arms, shoulder girdle, and spine (cervical, thoracic, and upper lumbar) in regard to strength, range of motion, and general efficiency.

L—Lower extremities: Functional use of the feet, legs, pelvic girdle, lower back musculature, and lower spine (lower lumbar and sacral) in regard to strength, range of motion, and general efficiency.

H—Hearing and ear defects: Auditory acuity and diseases and defects of the ear.

E—Eyes: Visual acuity and diseases and defects of the eye.

S—Psychiatric: Personality, emotional stability, and psychiatric diseases, including history of such.

Each of the PULHES factors of a qualified examinee is graded (profiled) on a numerical regressive scale from 1 to 3. Generally, profile 1 represents functional efficiency above the average, signifying no physical defect(s) or only minimal

physical defect(s); profile 2 represents average functional efficiency, with mild, nonprogressive physical defect(s); profile 3 represents functional efficiency below the average, with moderate physical defect(s) (borderline cases).

On the basis of this profiling system, a qualified examinee is assigned one of the following three physical categories: A, B, or C. Category A denotes no factor in the profile system is graded lower than 1; B—at least one factor is graded 2, but no factor is graded lower than 2; C—at least one factor is graded 3, but no factor is graded lower than 3.

The inductees and enlistees of this period were distributed by physical category as follows: A—77.2 per cent; B—15.0 per cent, and Category C—7.8 per cent (Table 4, Column 1).

Table 4. Distribution of qualified examinees and of total examinees, by physical category.

Physical Category	Per Cent of Examinees by Physical Category	
	Qualified[1] (1)	Total[2] (2)
Total	100.0	76.4
A	77.2	58.9
B	15.0	11.5
C	7.8	6.0

[1] Based on "Qualitative Distribution of Military Manpower" (26).
[2] Computed by multiplying each physical category (Column 1) by .764, which is the proportion of total examinees qualified (764 per 1,000 examinees, derived from Table 3, Column 5.)

Table 5. Distribution of youths by fitness for military service, Korean War* (July 1950 through July 1953).

Qualification	Per Cent
Total	100.0
Qualified	76.4
Physical Category A	58.9
Physical Category B	11.5
Physical Category C	6.0
Disqualified	23.6
Administrative Reasons	2.6
Mental Test Failure, Only	7.9
Mental Test Failure and Medical Reasons	1.8
Medical Reasons, Only	11.3

* Based on Tables 3 and 4.

Since our data indicate that the expected number of qualified is 764 per 1,000 youth (1,000 minus 236; Table 3, Column 5), the expected percentages of youths to be qualified in each physical category are: A—58.9, B—11.5, and

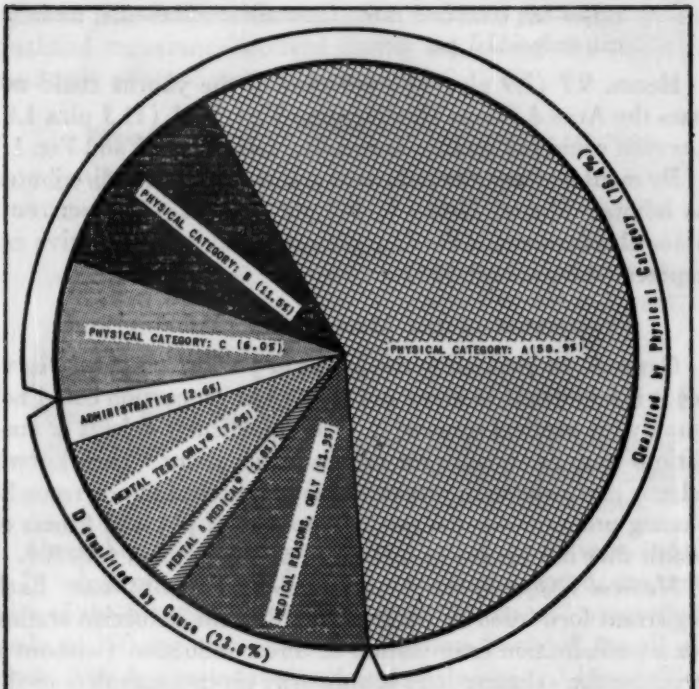

Fig. 1. Fitness of American youth for military service, Korean War.

C—6.0 (Table 4, Column 2). (*See* (27) for a diagnostic evaluation of the limiting defects in physical categories B and C.)

General Fitness of Youth for Military Service

Summing up, the Korean War experience with respect to fitness of American youth for military service thus indicates:

(a) *Qualified:* 76.4 per cent, distributed as follows by physical category: A—58.9; B—11.5; C—6.0 per cent;

(b) *Disqualified:* 23.6 per cent, distributed as follows by disqualifying cause: administrative 2.6; mental test failure,

only—7.9; combined mental test and medical—1.8; medical, only—11.3 per cent.

Hence, 9.7 (7.9 plus 1.8) per cent of the youths could not pass the Armed Forces Qualification Test; 13.1 (11.3 plus 1.8) per cent could not qualify medically. (*See* Table 5 and Fig. 1.)

By mental group, the inductees and enlistees were distributed as follows: Mental Group I—6.8 per cent; II—23.1 per cent; III—32.0 per cent; IV—33.3 per cent, and administrative acceptees—4.8 per cent (26).

Evaluation of the Medical Disqualifications

General. In evaluating the fitness of youth for military service it is important to know not only what proportion could not qualify for medical reasons, but what particular defects or conditions were responsible for the disqualifications. Such knowledge is pertinent with respect to any rehabilitation or reconditioning program—in the general problem of physical fitness of youth that has caused of late much public concern (28–30).

Medical Disqualifications at the Induction Stations. Each registrant forwarded by his local board to the induction station for a preinduction examination or direct induction (without a preinduction examination) is ordinarily given a complete medical examination. (Although prior to 1953, a chest x-ray was required only when the examinee was found otherwise medically qualified, it was accomplished in most cases.)

The medical examinations have been mostly performed by military medical officers. Currently, neither dental officers, nor psychiatrists, nor other medical specialists are assigned to the induction stations. However, provisions are made for the utilization of military hospitals, as well as civilian hospitals and civilian medical specialists, in cases requiring consultation.

The findings of the medical examinations are reported on Standard Form 88 ("Report of Medical Examination"). Each abnormality, whether disqualifying or not, is noted on the form. A copy of this form of each disqualified examinee and of each qualified examinee, inducted into the Army, is submitted to the

office of The Surgeon General, Army. From the forms of disqualified registrants received during this period the following randomly selected samples were coded:

Period Covered	*Sample Used (Per Cent)*	*Manner of Selection*
July 1950 through June 1951	20	Using two of the last odd digits in the Selective Service number assigned to the registrant by his local board
July 1951 through December 1951	100	All forms used
January 1952 through July 1953	50	Using all last odd digits of the registrant's Selective Service number.

Altogether, 284,000 copies of Standard Form 88 were coded.

In tabulating the coded data for the entire period, the samples of the first and last periods were "blown-up" proportionately to 100 per cent to provide uniform "weight" for all periods. The data were tabulated separately for: (a) Disqualified on preinduction or direct induction for medical reasons, only; (b) disqualified on preinduction or direct induction for both medical and mental reasons, and (c) disqualified at the time of induction. As expected, the separate tabulations revealed marked variations by diagnosis.

Local Board Medical Disqualifications. The manifestly disqualifying defects of registrants eliminated by the local boards were coded from DD Form 47 ("Record of Induction"). This form, which is initiated by the local board, carries the registrant's personal data, e.g., age, occupation, education, prior service, etc. This form is submitted to the induction station at the time the registrant is forwarded for induction processing. However, in case of registrants medically disqualified by the local boards—not forwarded to the induction stations, the dis-

qualifying defects are specified on the form under Section II: Local Board Medical Interview. The Selective Service regulations require that a copy of DD Form 47 of such registrants be forwarded by the local boards to the office of The Surgeon General, Army.

Table 6. Distribution of medically disqualified examinees by number of disqualifying defects, Korean War (July 1950 through July 1953).

Number of Disqualifying Defects	Number per 1,000 Examinees	
	Disqualified (1)	Disqualifying Defects (2)
Total	131.6	155.0
One	110.8	110.8
Two	18.2	36.4
Minimum Three	2.6	7.8

For the first year of the Korean War, all received forms were coded; a fifty per cent randomly selected sample was coded for the remainder of the period. Altogether, 75,000 copies of DD Form 47 were coded. The same "weighting" procedures, as applied to Standard Form 88, were used in tabulating the medical data from DD Form 47.

Overall Diagnostic Distributions. In order to present an overall diagnostic distribution of all medically disqualified examinees, the separate distributions of the various medically disqualified groups (disqualified by the local boards; disqualified on preinduction or direct induction for medical reasons, only; disqualified on preinduction or direct induction for mental and medical reasons; disqualified on induction) were combined on a proportional basis, in accordance with their respective disqualification rates.[3] The separate distributions were therefore weighted by the following ratios: 17:63:14:6, respectively.

Prevalence of Disqualifying Defects. Three disqualifying defects or conditions were the maximum coded for each examinee. Based on the combined distributions by diagnosis, it was found that 84.2 per cent of the registrants disqualified for med-

[3] The respective disqualification rates per 1,000 registrants in the overall evaluation were: 35.2; 134.6; 30.3; and 13.0 (Table 3).

ical reasons had one disqualifying defect or condition; 13.8 per cent had two; and 2.0 per cent had a minimum of three. Judging from the last percentage, we may presume that the per cent of these with more than three defects was very small.

The total prevalence of disqualifying defects among 1,000 youths was thus computed as 155.0 (Table 6, Column 2).

Disqualification Rates and Prevalence Rates of Disqualifying Defects, by Diagnostic Category. Both the disqualification and the prevalence rates of disqualifying defects are shown in Table 7 by broad diagnostic categories. The first column (Table

Table 7. Disqualification rates for medical reasons and prevalence of disqualifying defects, by diagnostic category, Korean War (July 1950 through July 1953).*

Diagnostic Category	Number per 1,000 Examinees	
	Disqualified for Medical Reasons (1)	Prevalence of Disqualifying Defects (2)
Total	131.6	155.0
Bones and Organs of Movement Diseases and Defects	20.0	23.3
Psychiatric Disorders	18.6	22.7
Circulatory System Diseases	17.8	20.0
Digestive System Diseases	11.2	12.4
Eye Diseases and Defects	9.8	14.1
Ear and Mastoid Process Diseases and Defects	8.3	10.4
Allergic Disorders	7.4	7.8
Infective and Parasitic Diseases	6.7	7.0
Neurological Diseases	5.4	5.9
Congenital Malformations	5.3	5.9
Failure to Meet the Anthropometric Standards	3.6	4.6
Neoplastic Diseases	2.6	2.9
Endocrine System Diseases	2.5	2.7
Skin and Cellular Tissue Diseases	2.5	3.1
Genitourinary System and Breast Diseases	1.6	2.0
Respiratory System Diseases (Nontuberculous)	1.5	1.8
Blood and Blood-Forming Organ Diseases	0.3	0.3
Metabolic Diseases and Avitaminoses	0.1	0.2
Miscellaneous Diseases and Defects	6.4	7.9

* The diagnostic categories (except "Miscellaneous diseases and defects") have been arranged in descending order of the disqualification rates. The diagnostic classification is in accordance with "Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death," 1955 Edition.

7, Column 1) indicates the number of individuals disqualified for the particular diagnostic category, among 1,000 youths. The various diagnoses included in the particular diagnostic category were in these cases either the sole, or the primary medical cause of disqualification when more than one defect was present. The most serious defect was ordinarily recorded as the primary cause of disqualification, though in some instances the more readily diagnosed condition could have been so selected.

The other column (Table 7, Column 2) indicates the total prevalence of disqualifying defects. This column shows the total number of disqualifying defects: sole (or primary) and secondary, among 1,000 youths. Thus, for instance 20.0 per 1,000 youths were disqualified because of disease or defects of the bones and organs of movement. However, additional 3.3 (23.3 minus 20.0) per 1,000 youths were also afflicted with these disqualifying defects, but their primary medical disqualifying cause was some other defect, presumably of a more serious nature.

Diseases and defects of the bones and organs of movement were obviously the main cause of the medical disqualifications, followed by psychiatric disorders, diseases of the circulatory system, etc. The distribution by diagnostic category (Table 7) was arranged in descending order of the medical disqualification rates, except for "miscellaneous diseases and defects," which include laboratory findings of unspecified cause and ill-defined conditions.

Specific Diagnoses. Because of the small numbers involved, the data by specific diagnoses (Table 8) were related to the medically disqualified youths, rather than to the total youth population. Thus, Column 1 (Table 8) shows the number of individuals disqualified for a particular diagnosis among 10,000 medically disqualified youths, while Column 2 (Table 8) presents the prevalence of the particular diagnosis among them.[4]

[4] When desired, the disqualification and prevalence rates of any particular diagnosis, similar to the rates given in Table 8 by diagnostic category, can obviously be obtained by multiplying the numbers presented in Table 8 for the particular diag-

(Continued on page 233)

The specific diagnoses were ordinarily chosen on the basis of their frequency but in some cases general interest in the particular diagnosis was the determining factor. The term "other," within a diagnostic category or subcategory, includes related diagnoses, usually of negligible frequency.

The following will be noted with respect to some specific diagnoses: (a) Ulcers, neoplasms, and rheumatic fever are primarily cases with history of such conditions, as new cases are seldom discovered or so diagnosed at the induction stations; (b) blindness indicates central distant visual acuity of 20/200 or less with the best correcting lens, or absence of eye; (c) deafness means auditory acuity of less than 8/15 by the whispered voice test; (d) venereal disease data do not reflect prevalence, since syphilis is acceptable for induction into military service, except for cardiovascular, visceral, or symptomatic cerebrospinal cases, or cases causing destructive lesions; likewise, uncomplicated acute or chronic gonorrhea and uncomplicated chancroid are acceptable for military service; and (e) active tuberculosis (all forms), pulmonary tuberculosis—active within the past 5 years; and spontaneous pneumothorax of tuberculous origin are not acceptable (17). (For a detailed study on the current prevalence of tuberculosis, *see* (31).

In this connection, the dental requirements should also be mentioned. During the first two and a half months of the Korean War, the dental requirements, established by a special directive, were four serviceable vital masticating teeth (bicuspids and molars) above and four below, serviceably opposed, plus four serviceable vital incisor teeth (incisors and cuspids) above, and four below, serviceably opposed. Teeth replaced by artificial dentures or bridges, and teeth with satisfactory fillings in the root canals were to be considered as serviceably vital teeth, when the history and clinical appearance clearly warranted such an assumption. Since the middle of September

nosis by .01316. The obtained products will be the disqualification and prevalence rates for the particular diagnosis, respectively, per 1,000 youths. For instance, the disqualification and prevalence rates of psychosis would be 1.7 (132 × .01316) and 1.8 (140 × .01316), respectively, per 1,000 youths.

Table 8. Distribution of medically disqualified registrants by disqualifying diagnosis, and prevalence of disqualifying defects, Korean War (July 1950 through July 1953).

Diagnosis	Base: 10,000 Medically Disqualified Registrants	
	Distribution by Disqualifying Diagnosis (1)	Prevalence of Disqualifying Defects (2)
Total	10,000	11,776
Psychiatric Disorders	1,412	1,721
Psychoses	132	140
Psychoneuroses	483	576
Character and Behavior Disorders	608	777
Mental Deficiency	189	228
Neurological Diseases	412	451
Cerebral Paralysis	80	84
Epilepsy	197	210
Peripheral Nerve Diseases	41	48
Other	94	109
Infective and Parasitic Diseases	506	532
Tuberculosis	233	246
Respiratory	208	219
Other	25	27
Venereal Diseases	20	22
Syphilis	15	17
Other	5	5
Late Effects of Acute Poliomyelitis	229	236
Other Infecuve and Parasitic Diseases	24	28
Neoplastic Diseases	197	220
Malignant Neoplasms	9	10
Neoplasms of the Lymphatic and Hematopoietic Tissues	6	7
Benign Neoplasms	164	182
Pilonidal Cyst or Sinus	135	147
Other	29	35
Unspecified Neoplasms	18	21
Allergic Disorders	565	594
Asthma	533	557
Other	32	37
Endocrine System Diseases	188	208
Diabetes Mellitus	114	118
Frohlich's Syndrome	19	22
Other	55	68

Table 8. (*Continued*).

Diagnosis	Base: 10,000 Medically Disqualified Registrants	
	Distribution by Disqualifying Diagnosis (1)	Prevalence of Disqualifying Defects (2)
Metabolic Diseases and Avitaminoses	8	11
Blood and Blood-Forming Organ Diseases	20	24
Eye Diseases and Defects	747	1,075
Inflammatory Diseases	22	30
Refractive Errors	154	185
Strabismus	156	188
Blindness, Bilateral	23	50
Blindness, Unilateral	169	327
Defective or Insufficient Vision, Not Specifically Defined	106	128
Other	117	167
Ear and Mastoid Process Diseases and Defects	627	793
Otitis Media	443	462
Tympanic Membrane Defects	22	129
Deafness, Bilateral	73	86
Deafness, Unilateral	27	36
Defective Hearing, Not Specifically Defined	32	42
Other	30	38
Circulatory System Diseases	1,353	1,518
Rheumatic Fever	41	44
Chronic Rheumatic Heart Disease	521	536
Arteriosclerotic and Degenerative Heart Diseases	121	127
Other Heart Diseases	176	197
Hypertensive Disease	417	518
Varicose Veins, Including Varicocele	39	45
Other Diseases of the Circulatory System	38	51
Respiratory System Diseases (Nontuberculous)	114	138
Digestive System Diseases	849	942
Ulcer of the Stomach, Duodenum, or Jejunum	161	172
Hernia of the Abdominal Cavity	459	490
Mouth and Adnexa Diseases, Including Teeth and Supporting Structures	172	209
Other	57	71

Table 8. (*Continued*).

Diagnosis	Base: 10,000 Medically Disqualified Registrants	
	Distribution by Disqualifying Diagnosis (1)	Prevalence of Disqualifying Defects (2)
Genitourinary System and Breast Diseases	123	154
Nephritis and Nephrosis	34	37
Kidney, Absence (Acquired)	26	28
Other Diseases of the Urinary System	29	36
Hydrocele	14	20
Other Male Genital Organ Diseases (Non-Venereal) and Diseases of the Breast	20	33
Skin and Cellular Tissue Diseases	189	237
Warts	26	34
Acne Vulgaris	21	24
Other	142	179
Bones and Organs of Movement Diseases and Defects	1,521	1,770
Arthritis	74	86
Spine (Including Neck)	21	25
Upper Extremities	8	9
Lower Extremities	28	32
Other Sites, or Generalized	17	20
Rheumatism	4	5
Osteomyelitis and Other Diseases of the Bone	178	191
Knee, Internal Derangement	126	139
Intervertebral Disc Displacement	36	39
Sacro-Iliac Joint, Affection	15	17
Ankylosis of Joint	46	57
Spine (Including Neck, But Excluding Sacro-Iliac Joint)	10	11
Upper Extremities	16	20
Lower Extremities	17	22
Other and Multiple Sites	3	4
Other Diseases of the Joints	71	80
Curvature of the Spine	101	119
Flatfoot	185	225
Clubfoot	80	89
Shortening of Lower Extremities	73	91
Other Musculoskeletal Diseases and Defects	108	144
Amputation of Extremities	141	152
Fingers	78	86
Other Upper Extremities	24	25
Toes	9	10
Other Lower Extremities	30	31

Table 8. (*Continued*).

Diagnosis	Base: 10,000 Medically Disqualified Registrants	
	Distribution by Disqualifying Diagnosis (1)	Prevalence of Disqualifying Defects (2)
Bones and Organs of Movement Diseases and Defects, Continued		
Limitation of Motion	104	125
Spine (Including Neck)	7	8
Upper Extremities	55	66
Lower Extremities	31	38
Other and Multiple Sites	11	13
Deformities and Impairments	179	211
Spine (Including Neck)	18	20
Upper Extremities	40	47
Lower Extremities	70	81
Other and Multiple Sites	51	63
Congenital Malformations	402	445
Nervous System and Sense Organs	52	59
Circulatory System	86	90
Digestive System	34	38
Cleft Palate and Harelip	29	32
Other	5	6
Genitourinary System	124	140
Undescended Testicles	107	120
Other	17	20
Bones and Joints	69	76
Lumbosacral Region	22	25
Other	47	51
Other Congenital Malformations	37	42
Failure to Meet the Anthropometric Standards	276	348
Underheight	41	47
Underweight (Except Malnutrition)	160	203
Overweight	58	80
Overheight	17	18
Miscellaneous Diseases and Defects	491	595
Symptoms Referable to Systems or Organs	203	263
Abnormal Urinary Constituents of Unspecified Cause	98	119
Other Diseases and Ill-Defined Conditions	190	213

1950, the dental standards were those specified in the Army Regulations, namely, that well-nourished individuals of good

musculature are acceptable, if they are free from gross dental infections, and have a minimum of an endentulous upper jaw and/or an edentulous lower jaw, corrected or correctible by a full denture or dentures. These requirements are the same as those which prevailed during World War II, after 1942 (2).

The distributions by specific diagnoses (Table 8) indicate the following main cause of disqualification within the diagnostic categories: Character and behavior disorders among the psychiatric disorders; epilepsy among the neurological diseases; pilonidal cyst among the neoplastic diseases; asthma among the allergic disorders; chronic rheumatic heart disease, followed closely by hypertensive disease, among the circulatory system diseases; hernia of the abdominal cavity among the digestive system diseases; undescended testicles among the congenital malformations; underweight among failure to meet the anthropometric standards, etc.

Appraisal of the Medical Data. The Armed Forces medical examinations have a specific end in view; namely, selection of men fit for the rigors of military service. They are intended to eliminate individuals with medical conditions or defects that are likely to cause any one or a combination of the following circumstances: endanger the health of other personnel; require excessive loss of time from duty by reason of treatment or hospitalization for conditions that may eventually result in separation from the service for medical unfitness; preclude satisfactory completion of required training; require excessive amount of geographic or other assignment restrictions; or become aggravated through the performance of military duty. The Army regulations specifically emphasize in this connection the likelihood of compensation claims against the government that may arise from separations from the service for medical disability (17, 32).

Although some disqualifying defects may not prevent an individual from pursuing his civilian occupation successfully (through selection of occupation or other adjustment), it must be recognized that even these defects constitute definite health

impairments. Of course, for proper evaluation, the specific defect or condition is to be judged in terms of its standards provided by the Army regulations (17). (*See* (33) on the general relationship of physical fitness to medical disqualifications for military service.)

Summary

1. The presented evaluation of the fitness of American youth for military service is based on the Korean War experience, from July 1951 through July 1953.

2. The prevailing basic statutory provisions and the moral, mental, and medical (physical and psychiatric) standards which determined the acceptability of men for military service during this period are briefly discussed.

3. Under the existing statutory provisions, generally all men between the ages 18 and 26 were liable for military service.

4. These individuals could discharge their military liability in several ways: they could voluntarily enlist into the Armed Forces, or enroll in the National Guard or other reserve programs (even before reaching the age of liability); or they could wait until drafted and forwarded by their local boards for induction. Outside inductions, voluntary enlistments has been a major source of manpower procurement by the Armed Forces.

5. Comprehensive data relating to the qualifications of youth for military service are available only with respect to the segment of the total liable manpower-pool that was processed by the examining stations for induction. (These are the commonly quoted disqualification data.) These data, however, are disproportionally weighted by youths who could not qualify for voluntary enlistment or the other reserve programs (apart from inductions), but were subsequently examined for induction.

6. In order to arrive at an overall evaluation of the fitness of youth for military service, the basic data dealing with the induction results of youths are presented first, and then adjusted for: (a) youths disqualified by the local boards, prior to the

induction processing; and (b) those who entered the military service through channels other than induction.

7. The adjusted data indicate the following results of the fitness of American youth for military service:

(a) 76.4 per cent qualified, distributed as follows by physical category A—58.9, B—11.5, and C—6.0 per cent. (The physical categories present a functional evaluation of fitness, from A—the highest, to C—the lowest).

(b) 23.6 per cent disqualified, distributed as follows by cause of disqualification: Administrative (essentially moral)—2.6; mental test failure, only—7.9; combined mental test failure and medical—1.8; medical, only—11.3 per cent. These rates indicate that 9.7 (7.9 plus 1.8) per cent of the youth could not meet the prevailing mental standards, as determined by the Armed Forces Qualification Test (AFQT); 13.1 (11.3 plus 1.8) could not qualify medically.

(c) By mental group, the qualified are distributed as follows: Mental Group I—6.8 per cent; II—23.1 per cent; III—32.0 per cent; IV—33.3 per cent, and administrative acceptees—4.8 per cent.

8. Detailed diagnostic distributions of the disqualifying defects and a general appraisal of these defects are presented.

APPENDIX

Technical Notes

I. Determination of Local Board Disqualifications

(a) *General.* 1. Asume the following probabilities:

d_1—probability that a registrant available for service (classified I-A) will be disqualified by his local board; hence, $(1-d_1)$ is the probability that he will not be disqualified by the local board;

d_2—probability that a registrant, not disqualified by the local board, will be disqualified at the induction station on preinduction examination, or on direct induction (without a preinduction examination);

d_2—probability that a registrant, found acceptable on the preinduction examination, will be disqualified by the induction station at the time of induction.

2. Denote by R the proportion of registrants who were given a preinduction examination, and by (1-R) the corresponding proportion of registrants who were processed for direct induction (without a preinduction examination).

3. $R(1-d_1)d_2$ represents, therefore, the probability that a registrant, not disqualified by the local board, will be disqualified on preinduction examination, and $(1-R)(1-d_1)d_2$ is the probability that such a registrant will be disqualified on direct induction. Obviously, the probability that a registrant will be disqualified either on preinduction examination or on direct induction is:

$$(1-d_1)d_2 \qquad [1].$$

4. Since $R(1-d_1)d_2$ is the probability that a registrant will be disqualified on preinduction examination (3, above), the corresponding probability that the registrant will be qualified is:

$$R(1-d_1)(1-d_2) \qquad [2],$$

and the probability that the latter will be disqualified at the time of induction is:

$$R(1-d_1)(1-d_2)d_3 \qquad [3].$$

5. On the basis of [1] plus [3], the combined probability that a registrant will be disqualified by the induction station either on the preinduction examination (or direct induction) or at the time of induction is:

$$(1-d_1)d_2+R(1-d_1)(1-d_2)d_3 \qquad [4].$$

6. Assume that N represents the number of registrants processed for induction during a certain period of time. Therefore, Nd_1 is the number of registrants expected to be disqualified by the local boards, and, on the basis of [4], $N\,[(1-d_1)d_2+R(1-d_1)(1-d_2)d_3]$ is the number of registrants expected to be disqualified by the induction stations.

7. Let K signify the ratio of the number of registrants disqualified by local boards to the number of registrants disqualified by the induction stations. Consequently, from 6, above:

$$K = d_1/(1-d_1)d_2+R(1-d_1)(1-d_2)d_3 \qquad [5].$$

(b) *Specific.* 1. The preinduction and induction data for the Korean War (July 1950 through July 1953), indicate the following specific values: $d_2 = .3183$, the disqualification rate (to a base of 1) for not-previously examined registrants (Table 1, Column 4), which is also taken as the disqualification rate on direct induction; $d_3 = .0274$, the disqualification rate (to a base of 1) at the time of induction (Table 2, Column 4).

2. The proportion of registrants forwarded by the local boards who were given a preinduction examination during this period was determined as .965. Hence, $R = .965$, and $(1-R) = .035$, the latter figure is the proportion of registrants processed for direct induction.

3. It was calculated from data published by the Selective Service Headquarters (34), that 261,394 registrants were rejected by the local boards in relation to registrants who were processed for induction during this period. The number of registrants who were disqualified by the induction stations during this period was 1,193,471—on preinduction (not-previously examined registrants) and induction examinations. Thus:

$$K = 261{,}394/1{,}193{,}471 = .2190 \qquad [6].$$

(Approximately the same ratio (.211) of disqualifications by local boards to those by the induction stations is indicated in the One-Percent Sample-Inventory carried out by the Selective Service Headquarters on the distribution of IV-F Class as of April 1953 (35), p. 1.)

4. Substituting in [5] the specific values of K, d_2, d_3, and R, given above:

$$d_1 = .0686 \qquad [7]$$

which is the specific probability that a registrant will be disqualified by the local board.

II. Combined Results

(a) *General.* 1. Expressing the specific prohabilities (I(b), above) as disqualification rates to a base of 1,000, the following number of registrants are expected to be disqualified at the various stages of examination: 68.6 ($= 1000\ d_1$), by the local boards; 296.5 ($= 1000\ (1-d_1)d_2$) on preinduction examination or direct induction, and 17.4 ($= 1000\ d(1-d_1)(1-d_2)d_3$) at the time of induction (Table 3).

2. The combined disqualification rate per 1,000 registrants examined for induction, designated as D, is thus:

$$D = 382.5 \qquad [8].$$

the corresponding qualification rate, denoted as Q, is

$$Q = 1{,}000 - 382.5 = 617.5 \qquad [9],$$

and the probability of being qualified (base = 1), denoted as q, is:

$$q = .6175 \qquad [10].$$

(b) *Distribution of Disqualifying Rates by Broad Disqualifying Cause.* 1. The local board data (34) indicate that 44 per cent of the disqualifications were for administrative (moral) reason, and 56 per cent for medical reasons. The latter disqualifications include a certain number of registrants who were disqualified by some local boards for mental reasons, though no provision was made for mental testing by the local boards. These disqualified registrants are "illiterates," and individuals who, in the opinion of the local boards, would not pass the Armed Forces mental test. The disqualification rates at the local boards by disqualifying cause were thus determined as: 30.2 for administrative reasons; 3.2 for mental reasons, and 35.2 for medical reasons (Table 3, Column 1).

2. The disqualification rate (296.5) on preinduction examination, or direct induction examination (*a*, above), by disqualifying cause was distributed proportionally on the basis of the distribution by disqualifying cause as shown in Table 1 (Column 4). This distribution is shown in Table 3 (Column 2).

3. The distribution of the disqualification rate (17.4) at the time of induction by disqualifying cause, as shown in Table 3 (Column 3), was computed on the basis of the distribution by disqualifying cause presented in Table 2 (Column 4).

4. The distribution of the combined disqualification rate by disqualifying cause (Table 3, Column 4) presents a summation of the individual distributions (Columns 1, 2, and 3, line by line).

III. Overall Disqualification Rate

(a) As pointed out in the text, the Armed Forces procure their manpower through inductions and other sources—enlistments, Reserves, ROTC, etc. Assume E to represent the proportion of liable

manpower pool procured by the Armed Forces through sources other than inductions. Consequently, (1-E) is the proportion of the liable manpower pool processed for induction, and (1-E)q is the proportion qualified from the latter group.

(b) Denote by S the ratio of E to (1-E)q:

$$S = E/(1-E)q \qquad [11]$$

(c) It was computed that 2,521,949 men were procured by Armed Forces through sources other than inductions in relation to the 2,514,779 registrants who were qualified for service during this period through induction processing. The former number was derived from the distributions of enlistees, without previous service (or first enlistments), by year of birth, and other sources. Thus:

$$S = 2{,}521{,}949/2{,}514{,}779 = 1.0029 \qquad [12]$$

In other words, for each 1,000 qualified registrants, 1,003 youths were procured through sources other than induction.

(d) Substituting in [11] the values of q (= .6175), as shown in [10], and S (= 1.0029), as shown in [12], and solving for E:

$$E = .3824$$
$$\text{and } (1-E) = .6176 \qquad [13]$$

the former being the proportion of manpower procured through sources other than inductions, the other the proportion processed for induction.

(e) Thus, of each 1,000 men in the manpower pool, 382.4 men were procured for military service through sources other than induction, and 617.6 men were processed for induction. Since the disqualification (D) for the latter group was 382.5 per 1,000 registrants examined for induction [8], the overall disqualification rate (T) adjusted for the acquisition of manpower through sources other than by induction is:

$$T = (.6176)(382.5) = 236.2 \qquad [14]$$

(The Department of Labor (36) computed on the basis of the One-Per Cent Sample-Inventory of the Selective Service the per cent of IV-F class as 22 for the 22–24 age group. Our data include, of course, a wider age range.)

(f) The distribution of the overall disqualification rate by disqualifying cause is presented in Table 3, Column 5. It was derived by multiplying each of the disqualification rates by cause (Table 3, Col-

umn 4) by .6176 [13]. It will be noted (Tables 3 and 5), that our disqualifiation rate for mental reasons is 9.7 per cent (7.9 per cent for failing mental test, only, plus 1.8 per cent for failing the mental test and being medically disqualified)—practically the same as the minimum requirements of 10 percentile, established for the purpose of eliminating 10 per cent of the population of the lowest aptitude. (Merck and McMahan (37), using a different approach to the problem, arrived at a disqualification rate of 10.9 per cent as of 1956, in estimating from the induction data AFQT failures for the total male population.)

References

1. Selective Service National Headquarters: Annual Reports of the Director of Selective Service to the Congress of the United States. Fiscal years 1951–1954.

2. Office of The Surgeon General, Army: General Review of the Induction Experience under the Selective Service Extension Act of 1950. *Health of the Army*, September, 1951, 6, pp. 1–13.

3. Office of The Surgeon General, Army: Review of the First Six-Month Induction Experience Under the Universal Military Training and Service Act. *Health of the Army*, April, 1952, 7, pp. 2–8.

4. Office of The Surgeon General, Army: Review of Induction Experience during the Calendar Year 1952. *Health of the Army*, April, 1953, 8, pp. 2–12.

5. Office of The Surgeon General, Army: Results of Reexaminations of Selective Service Registrants. *Health of the Army*, October, 1953, 8, pp. 2–7.

6. Office of The Surgeon General, Army: Induction Experience during the Calendar Year 1953. *Health of the Army*, February, 1954, 9, pp. 2–10.

7. Assistant Secretary of Defense (Manpower Utilization Division): Effects of Armed Forces Qualifying Examinations upon Manpower Availability under the Universal Military Training and Service Act of 1951. March, 1952.

8. Department of the Army: Enlisted Personnel, Joint Examining and Induction Station Procedures. *Special Regulations* (SR 615-180-1), 1950, and Changes, 1951 and 1953.

9. Department of the Army: Enlisted Personnel, Armed Forces Examining Stations. *Special Regulations* (SR 615-100-1), 1951, and Changes, 1953.

10. Department of the Army: Army Personnel Tests and Measurement. *TM* 12-260, April, 1953.

11. Bolanovich, D. J., Jones, W., and Lovelace, N. R.: Follow-up of the Standardization of the Armed Forces Qualification Test. *PRS Report* 959, June, 1952.

12. Uhlaner, J. E., and Bolanovich, D. J.: Development of Armed Forces Qualification Test and Predecessor Army Screening Tests, 1946–1950. *PRS Report* 976, November, 1952.

13. Bolanovich, D., Mundy, J. P., Burke, L. K., and Falk, G. H.: Development of the Armed Forces Qualification Test, Forms 3 and 4. *PRB Technical Research Report* 1078, October, 1953.

14. Baier, D. E.: Screening and Initial Classification. (*In:* The Selection of Military Manpower, A Symposium. Edited by Leonard Carmichael and Leonard C. Mead). National Academy of Sciences–National Research Council, Washington, D. C., 1951, pp. 224–235.

15. Bergin, W. E.: Revised Mental Tests for the Armed Forces. *Army Information Digest,* July, 1953, 8, pp. 42–46.

16. Karpinos, B. D.: Evaluation of the Physical Fitness of Present-Day Inductees. *U. S. Armed Forces Medical Journal,* March, 1953, 4, pp. 415–430.

17. Department of the Army: Medical Department, Physical Standards and Physical Profiling for Enlistment and Induction. *Army Regulations* (AR 40-115), 1948, and Changes.

18. Ginzberg, E.; Anderson, J. K.; Ginsburg, S. W.; and Herma, J. L.: The Lost Divisions. Columbia University Press, New York, 1959.

19. Eanes, R. H.: Standards Used by Selective Service and a Follow-Up on Neuropsychiatric Rejectees in World War II. (*In* The Selection of Military Manpower, A Symposium. Edited by Leonard Carmichael and Leonard C. Mead). National Academy of Sciences–National Research Council, Washington, D. C., 1951, pp. 149–156.

20. Fry, C. C.: A Study of the Rejection Causes, Success and Subsequent Performance of Special Groups. (*In:* The Selection of Military Manpower, A Symposium. Edited by Leonard Carmichael and Leonard C. Mead). National Academy of Sciences–National Research Council, Washington, D. C., 1951, pp. 133–148.

21. Brill, N. Q., and Beebe, G. W.: Psychoneuroses: Military Applications of a Follow-Up Study. *U. S. Armed Forces Medical Journal,* January, 1952, 3, pp. 15–33.

22. Glass, A. J.; Ryan, F. J.; Lubin, A.; Ramana, C. V.; and Tucker, A. C.: Psychiatric Prediction and Military Effectiveness. *U. S. Armed Forces Medical Journal,* October, 1956, 7, pp. 1427–1443; November, 1956, 7, pp. 1575–1588; March, 1957, 8, pp. 346–357.

23. The Surgeon General, Army: Annual Report, Medical Statistics of the United States Army, Calendar Year 1953, pp. 86–92.

24. Department of the Army: Enlisted Personnel, Summary of Registrant Examinations for Induction. *Special Regulations* (SR 615-180-5), 1951 and Changes, 1952.

25. Selective Service National Headquarters: Disqualifying Obvious Defects and Manifest Conditions. *Selective Service System Regulations,* Part 1629.

26. Adjutant General, Army: Qualitative Distribution of Military Manpower (May 1951 through July 1953).

27. Karpinos, B. D., and Souther, G.: Limiting Defects of Army Inductees in Physical Categories B and C. *U. S. Armed Forces Medical Journal,* December, 1956, 7, pp. 1791–1801.

28. President's Council on Youth Fitness: Fitness of American Youth, A Report to the President of the United States on the Annapolis Conference, June, 1956, Washington, D. C.

29. State of Illinois: Report of the Governor's Conference on Youth Fitness, May, 1957, Springfield, Illinois.

30. President's Council on Youth Fitness: A Report to the President of the United States on the Fort Ritchie Meeting, September, 1958. Washington, D. C.

31. Karpinos, B. D.: Prevalence of Tuberculosis among Selective Service Registrants Currently Processed for Military Service. *American Review of Respiratory Diseases,* December, 1959, 80, pp. 795–805.

32. Meador, C.: Physical Standards—Evaluation of Fitness for Duty-Pension. *Military Medicine*, September, 1959, 124, pp. 646–647.

33. Karpovich, P. V.: Physical Fitness—Why, How Much, and How to Acquire. *Industrial Medicine and Surgery*, August, 1956, 25, pp. 372–375.

34. Selective Service National Headquarters: Statistical Digest (A-Series), published monthly by the Statistics Section, Research and Statistics.

35. Selective Service National Headquarters: Who Rejects the IV-F's, *Sample Inventory*. Release No. 11.

36. United States Department of Labor (Bureau of Labor Statistics): Military Manpower Requirements and Supply, 1954–1960. *Bulletin* No. 1161, March, 1954.

37. Merck, J. W., and McMahan, C. A.: Estimates of Failures of the Armed Forces Qualification Test, 1956. Research Report, AFPTRC-TN-57-67, June, 1957.

SOCIO-ECONOMIC AND SEASONAL VARIATIONS IN BIRTH RATES[1]

BENJAMIN PASAMANICK, M.D., SIMON DINITZ, PH.D., AND HILDA KNOBLOCH, M.D.

IN recent years few serious scholars have interested themselves in the effect of climatic variations upon social phenomena. Even when seasonal variations have been apparent, as, for example, in the rate of various types of reported crime, sociological and psychological explanations have prevailed. In this process of utilizing cultural and psychological interpretations in preference to climatic, interest in the latter has waned. This is perhaps unfortunate since useful insights might be gained by analyzing climatic variables as they affect social phenomena.

This paper attempts to summarize some of our findings on the hypothesized relationship of seasonal variations to the birth rate, to the rate of complications of pregnancy, to the frequency of birth of mentally deficient children, and to socio-economic status.

Our interest in and research on the etiology and control of the complications associated with pregnancy and the effects of these complications on the frequency of neuropsychiatric and other disorders in children almost inadvertently led us into the area of climatic variations. In a series of studies of month of birth of mentally deficient children, (Knobloch and Pasamanick, 1958) and of the complicated pregnancies which are associated with mental defect, (Pasamanick and Knobloch, 1958) it was found that the peak period of conception was late spring and early summer. From this it followed that the critical period for fetal central nervous system development, the 8th to 12th weeks of gestation, had occurred during the summer months. Further, the highest rates of mental deficiency

[1] Research Division, Columbus Psychiatric Institute and Hospital, Department of Psychiatry, College of Medicine, The Ohio State University.

occurred in those years in which the summer temperatures were above the median. In interpreting this excessive rate of reproductive casualty resulting from early summer conception, two etiologic factors were postulated. These were decreased protein intake during the summer and heat stress.

Not only are the complications of pregnancy and mental deficiency associated with season of conception, but previous evidence (Pasamanick and Knobloch, 1958a) shows these abnormalities have an even more important association with socio-economic status. Since these complications are much more frequent in the lower socio-economic strata, both white and Negro, it is necessary to eliminate the socio-economic factor in order to substantiate the role of summer and its concomitants, heat stress and reduced protein intake, in producing complications of pregnancy and injury to the fetus. Two aspects need to be considered: (1) the general pattern of seasonal variations in birth and conception and (2) the socio-economic variations in season of birth.

Seasonal Variations in Birth

It has long been known that there are marked seasonal variations (Huntington, 1938 and Mills, 1939) in the birth rate in the United States and, indeed, throughout the Western world. These variations include a pronounced trough in the percentage of total births occurring in the spring months of March, April, and May and a corresponding peak in the late summer months of August and September. This biannual variation applies to the births of whites and non-whites, and males and females.

The August–September peak has traditionally and rather facetiously been attributed to increased sexual activity during the longer and colder winter nights. The explanation for the consistent spring depression in births has been less obvious. Three interrelated variables have been postulated as explanations. The first and most obvious is that *high* summer temperatures and humidity reduce the risk of conception. There are

two ways in which this may occur. Temperature discomfort may, first, reduce sexual activity and, second, adversely affect the viability of the sperm. There is some very interesting evidence in support of this reduced conception risk hypothesis. If sexual activity and/or sperm viability is reduced or increased with temperature and humidity variations, then those states which have semi-tropical summer climates should exhibit the greatest troughs in spring births while states with only minor annual fluctuations in temperature should have only a slight spring depression or none at all. In order to assess the validity of this hypothesis, the monthly birth rates were compared in four groups of states as well as in the United States as a whole. The four groups of states in order of their presumed gradient in lowered spring births were the Southeastern, Midwestern, Northeastern, and Northwestern (Shapiro and Halpin, 1947).

From the 1955 data on births by month, state, sex, and race (Table 23, pp. 207–211) issued by the National Office of Vital Statistics, it was apparent that the spring dip did correspond to summer temperatures. Instead of the normal 8.3 per cent expectancy, the percentage of April white male births, for example, was 7.8 per cent in the United States, 6.7 per cent in Mississippi, 8.0 per cent in Wisconsin, 8.2 per cent in Maine, and 8.5 per cent in Washington. Similar results (Pasamanick, Dinitz and Knobloch, 1959) were also obtained for contiguous states in the same region.

These same data also lend credence to the second hypothesis, which suggests that there is an increased fetal death rate among conceptions occurring immediately prior to and during the summer months. As noted previously, the suggested causes for the increased fatalities are protein deficiencies and heat stress. The hypothesized mechanism could be via the hypothalamic-pituitary-adreno-cortical system which has been implicated in fetal deaths in animals consequent to experimental stress. It should be noted, also, that the peak period of neonatal death rates in the first 28 days of life is the spring. This again indicates that these children were conceived when there was prob-

ably maximum temperature stress and, equally probably, some concurrent dietary deficiencies, which give rise to brain damage.

The third explanation for the spring decline in births is purely statistical in character and admittedly accounts for a small fraction of this decline. The point here is that increased births during the late summer months automatically eliminate the conception and delivery of children during the preceding and succeeding spring months.

Socio-Economic Variations in Births

The preceding data leave little doubt that, however interpreted, climatic variations play an important role in birth and infant death rates. These effects, however, are not randomly distributed among all segments of the population. The lower the socio-economic group, the more closely its vital statistics tend to conform to the general pattern of the spring trough. The higher the socio-economic group, the less the departure from the normal expectancy of 8.3 per cent.

No reports of monthly births by socio-economic groups are available for the United States or any of the States; such data were therefore gathered for a five-year period, 1952–1956, in Baltimore, Maryland. The census tract of residence of the mother was used as the criterion of socio-economic status. For the whites the census tracts were divided into ten groups on the basis of median rental or value of the dwelling property. Non-whites were treated as a single group.

During the period 1952–1956, there was an annual average of 23,100 births to Baltimore residents. Of these, some 37 per cent were non-white births. Somewhat surprisingly, the number and percentage of births in the highest socio-economic fifth of the population exceeded the number in any of the other socio-economic fifths. This is probably largely a function of the census tract classification used and the larger number of non-white residents in the other four socio-economic categories.

Table 1 presents the adjusted (for number of days per month) number and percentage of births in the non-white

Table 1. Adjusted monthly distribution of births to Baltimore residents, 1952–1956, by white socio-economic fifths and non-whites.

Month	Non-White		Lowest Fifth		Lower Middle Fifth		Middle Fifth		Lower Upper Fifth		Highest Fifth	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
January	3,493	8.2	1,216	8.5	1,186	8.5	1,052	8.5	1,097	8.4	1,423	7.5
February	3,466	8.1	1,186	8.3	1,174	8.4	1,049	8.5	1,125	8.6	1,690	8.9
March	3,308	7.7	1,155	8.1	1,073	7.7	988	8.0	1,028	7.9	1,584	8.3
April	3,055	7.1	1,031	7.2	1,000	7.2	939	7.6	991	7.6	1,542	8.1
May	3,080	7.2	1,009	7.1	976	7.0	912	7.4	933	7.2	1,569	8.2
June	3,599	8.4	1,164	8.1	1,104	7.9	964	7.8	1,122	8.6	1,529	8.0
July	3,894	9.1	1,304	9.1	1,231	8.8	994	8.1	1,152	8.8	1,627	8.5
August	3,937	9.2	1,277	8.9	1,283	9.2	1,140	9.2	1,079	8.3	1,605	8.4
September	3,931	9.2	1,337	9.4	1,338	9.6	1,146	9.3	1,170	9.0	1,702	8.9
October	3,642	8.5	1,274	8.9	1,222	8.7	1,010	8.2	1,097	8.4	1,600	8.4
November	3,593	8.4	1,158	8.1	1,185	8.5	1,031	8.4	1,079	8.3	1,569	8.2
December	3,770	8.8	1,176	8.2	1,207	8.6	1,113	9.0	1,164	8.9	1,641	8.6
Total	42,768		14,287		13,979		12,338		13,037		19,081	

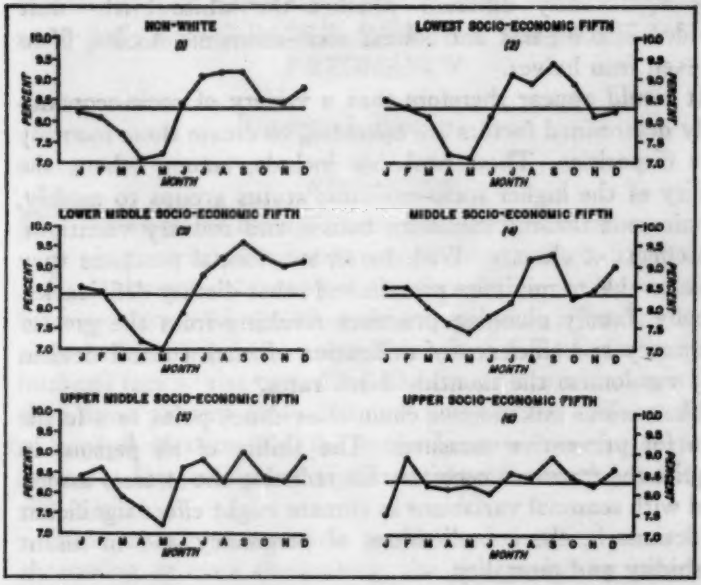

Fig. 1. Adjusted monthly births to Baltimore residents, 1952–1956, by white socio-economic fifths and by non-white.

group and in each of the white socio-economic fifths. Observations of this table, and of Figure 1 which portrays the same data graphically, reveals that there is a very pronounced but not quite perfect gradient in the percentage of summer and of spring births. As predicted, the amount of over-representation of summer births varies inversely with socio-economic status. The highest summer birth rates are tc be found in the non-white group and in the lowest three fifths of the socio-economic continuum. Even more significantly from the point of view of this paper, the greatest spring trough in births occurs in these same groups. On the other hand, the highest socio-economic status category exhibits the smallest monthly variability in births. The curve for this group comes close to approximating a straight line.

Tests of significance for the various distributions add statistical validity to this graphic picture. The spring trough in births

was significantly different whether the white births were divided into highest and lowest socio-economic deciles, fifths or even into halves.

It would appear therefore that a variety of socio-economically determined factors are operating to create these monthly rate disparities. These probably include, among others, the ability of the higher socio-economic status groups to modify, by air conditioning, suburban homes, and country vacations, the effects of climate. With better nutritional practices they are also able to minimize protein and other dietary deficiencies. Finally, family planning practices resulting from the greater frequency and efficiency of utilization of birth control devices help randomize the monthly birth rates.[2]

The various links in this chain of evidence point to a fertile area for preventive measures. The ability of all persons to acquire the resources necessary for reducing the stresses associated with seasonal variations in climate might effect significant reductions in the complications of pregnancy and in infant morbidity and mortality.

References

Huntington, E.: Season of Birth. New York, John Wiley and Sons, Inc., 1938.

Knobloch, H. and Pasamanick, B.: Seasonal Variation in the Births of the Mentally Deficient. *American Journal of Public Health*, September, 1958, 48, No. 9, p. 1201.

Mills, C. A.: Medical Climatology. Springfield, Ill., Charles Thomas, 1939.

Pasamanick, B. and Knobloch, H.: (1958). Seasonal Variation in Complications of Pregnancy. *Obstetrics and Gynecology*, July, 1958, 12, No. 1, p. 110.

Pasamanick, B. and Knoblock, H.: Race, Complications of Pregnancy, and Neuropsychiatric Disorder. *Social Problems*, Winter 1957–58, 5, No. 3, p. 367.

Pasamanick, B., Dinitz, S. and Knobloch, H.: Geographic and Seasonal Variations in Birth. *Public Health Reports*, April, 1959, 74, No. 4, p. 285.

Shapiro, S. and Halpin, E.: Seasonal Variation in the Crude Birth Rate. *Vital Statistics of the United States, Special Reports*, December 4, 1947, 23, No. 17, p. 329.

[2] It is possible that seasonal differences in marriage rates, by class, might account for the differential troughs and peaks noted above. Such an interpretation does not seem very probable. An investigation of class variations in the month and season of marriage in Franklin County, Ohio from 1933–1958, conducted by these authors, proved negative on this point.

SOME RELATIONSHIPS BETWEEN SHORT RANGE AND LONG RANGE RISKS OF UNWANTED PREGNANCY

ROBERT G. POTTER, JR.[1]

INTRODUCTION

TODAY in the United States it is common for a woman to be married near her twentieth year, to have her 2, 3, or 4 desired children by thirty, but not to lose her capacity for pregnancy until age 40 or somewhat later. If her first marriage endures until the menopause, then usually she and her husband face a "risk period" of 10 years or longer during which they must prevent any additional pregnancies. This problem of family limitation is all the harder because ease of conception typically does not decline significantly until near the end of the risk period.

Some couples solve their problem of fertility control by shortening or even eliminating, the risk period by means of sterilization. According to evidence collected in a recent survey, only a minority in the United States use this drastic solution while the majority rely, or try to rely, entirely on contraception.[2]

It has been shown in another article that very efficient contraception is required for a half-chance, much less a good chance, of full protection during a risk period as long as 10 years.[3] Such efficiency is not always attained. While some couples are able to adjust themselves to one or two unintended pregnancies, presumably very few couples are prepared to accommodate themselves to three or more excess pregnancies. Three excess pregnancies may appear as very ineffective family

[1] Office of Population Research, Princeton University. The writer is indebted to W. D. Borrie and P. C. Sagi for their valuable criticisms.

[2] Freedman, Ronald; Whelpton, Pascal K.; and Campbell, Arthur A.: FAMILY PLANNING, STERILITY, AND POPULATION GROWTH. New York, McGraw-Hill, 1959, pp. 26–31, 64–68.

[3] Potter, R. G.: Some Problems in Predicting a Couple's Contraceptive Future. *Eugenics Quarterly*, December, 1959, 6, pp. 254–256.

limitation. Yet it can be shown that when risk periods are as long as ten years, it requires surprisingly efficient contraception even to be reasonably assured of not experiencing three unsought pregnancies.

Accordingly, interest attaches to the levels of contraceptive efficiency needed in order to provide a high assurance, say a .95 chance, of not exceeding one excess pregnancy or, at the least, not exceeding two excess pregnancies. More specifically, how low must the monthly risk of pregnancy be kept in order to have, during risk periods of stated length, a specified likelihood of not exceeding x pregnancies? Deriving answers to this question is complicated by the fact that conception is followed by several months of pregnancy, amenorrhea, and anovulatory cycles. During this "immunity period" reimpregnation is impossible and the remainder of the risk period is shortened correspondingly.

V. M. Dandekar has published a "modified binomial distribution" which takes account of these immunity periods.[4] It is the objective of this paper to show the relevance of Dandekar's model and then to apply it to the problem outlined.

Length of Risk Period

Typically risk periods are longest when no recourse is made to sterilization and the marriage remains intact until the couple are past childbearing. In such cases, the risk period starts when the couple recover their capacity for conception after the last desired birth; it ends when the couple become sterile, an event usually synonymous with the wife's loss of capacity to become pregnant.

According to 1950 census figures, in the United States the median age of brides at first marriage is 20 years.[5] Two, three, and four children are the most popular family sizes.[6] These

[4] Dandekar, V. M.: Certain Modified Forms of Binomial and Poisson Distributions. *Sankhya*, July, 1955, pp. 237, 238.

[5] Glick, Paul C.: American Families. New York, John Wiley and Sons, 1957, p. 54.

[6] Freedman, *et al*, *op. cit.*, pp. 220–226. The roughly equal popularity of 2, 3 or 4

(Continued on page 257)

facts, together with what is known about child-spacing,[7] suggest that a majority of once-married wives reach desired family size, if ever, during ages 25 to 30. The inference that a majority of wives reach their preferred family size by thirty is more suspect for remarriages. Nor does it necessarily apply to those first marriages in which an accidental pregnancy occurs after the last intended child, since the number of children wanted may then be adjusted to accommodate the newcomer.

The end of the risk period is best measured in terms of the age distribution of wives at last confinement in societies practicing little family limitation for marriages enduring until the end of the reproductive period. Tietze furnishes such an age distribution for 204 Hutterite women, but the ages are grouped into five-year classes.[8] Hyrenius offers a more detailed age distribution for 581 Swedish women.[9] Agreement between the two distributions is good and Hyrenius' distribution is chosen chiefly because of its greater detail and larger sample size.

Several sets of data indicate that in societies practicing little family limitation consecutive birth intervals average approximately the same length until the penultimate interval, which is barely longer, and the last birth interval, which is moderately longer.[10] This evidence suggests that fecundability—i.e., ease

children is also found in a recent study of two-child families in metropolitan areas over 2,000,000: Westoff, Charles F.; Potter, Robert G., Jr.; Sagi, Philip C.; and Mishler, Elliot G.; FAMILY GROWTH IN METROPOLITAN AMERICA, to be published by Princeton University Press.

[7] Child-spacing data based on the Census Bureau's Current Population Survey for April 1954 yields approximate median intervals of 2.0, 2.7, 2.7, and 2.3 years between marriage and first birth, first and second birth, second and third birth, and third and fourth birth respectively. *See* Child Spacing as Measured from Data Enumerated. *In* the Current Population Survey: United States, April 1950 to April 1954. *Vital Statistics-Special Reports,* October, 1958, 47, No. 3, p. 92.

[8] Tietze, C.: Reproductive Span and Rate of Reproduction among Hutterite Women. *Fertility and Sterility,* January–February, 1957, 8, p. 91.

[9] Hyrenius, H.: Fertility and Reproduction in a Swedish Population Group without Family Limitation. *Population Studies,* November, 1958, 12, pp. 121, 122.

[10] Direct evidence comes from Henry, Louis: ANCIENNES FAMILLES GENEVOISES. Presses Universitaires de France, 1956, pp. 122–124, and Tietze, *op. cit.,* pp. 92, 95. In these two studies, the last intervals average 12 and 6 months longer than prior intervals, respectively. Additional evidence of the essentially constant length of successive birth intervals, classified by parity, is in Hyrenius, H.: *op. cit.,* p. 128, and Henry, L.: Intervals Entre Naissances. *Population,* October–December, 1954, pp.

(Continued on page 258)

Wife's Age at Start of Risk Period	Percentages of Risk Period As Long As:		
	10 Years	15 Years	20 Years
25	85	56	7
30	57	7	—
35	8	—	—

Table 1. Percentages of risk periods as long as 10, 15, and 20 years, by age of wife at start of risk period, assuming that marriage endures until end of reproductive period.

of conception in the absence of anti-conception measures—remains essentially uniform until quite close to the last birth. Accordingly, the assumption that fecundability remains constant throughout the risk period is not too unrealistic, especially when one is dealing with long risk periods, say 10 years or longer.

In Table 1, the percentages of risk periods longer than 10, 15, and 20 years are given for women attaining desired family size and recovering fecundability at specified ages. It is assumed that marriages endure until age at last birth, distributed as in Hyrenius' distribution. It is seen with this restriction over half the wives reaching desired family size between ages 25 to 30 theoretically experience risk periods longer than 10 years and an appreciable minority experience risk periods as long as 15 years. For this reason, the analysis below will focus on risk periods of 10 and 15 years duration. Risk periods of 20 years do not assume numerical significance except for women having all the children they want by their early twenties.

The Model

A model is needed which can convert monthly likelihoods of accidental pregnancy into probabilities of not exceeding 0,

759–761, and Tuan, Chi-Hsein: Reproductive Histories of Chinese Women in Rural Taiwan. *Population Studies*, July, 1958, 12, p. 49. The only experience representing an apparent exception to the generalization that consecutive intervals do not lengthen appreciably with parity comes from Henry, L.: Intervals Between Confinements in the Absence of Birth Control, *Eugenics Quarterly*, December 1958, 5, pp. 202–203. But this analysis is restricted to the first four "normal" birth intervals of only 46 couples and Henry, admitting the inconsistency of these results with previous results, seeks an explanation in terms of progressively longer time lapses between birth and next onset of ovulation as parity increases.

1, 2, . . . excess pregnancies during risk periods of specified length. The model must allow for the periods of immunity following conception when reimpregnation is impossible.

Three simplifying assumptions are made:

(i) Any conception is followed by a constant immunity period of (m-1) months during which reimpregnation is impossible.

(ii) The monthly likelihood of pregnancy despite contraception remains constant at p throughout the risk period of n months, except during immunity periods when it is zero.

(iii) All events—i.e., conceptions, ends of immunity periods, start and finish of risk period—occur in the middle of the month.

From (i)–(iii), it follows that conception may occur any month of the risk period provided that a conception has not occurred during one of the preceding $(m-1)$ months.

These assumptions correspond to those made by Dandekar in deriving his modified binomial distribution. Adopting his notation, let $P(r,n)$ be the probability of r excess pregnancies in a risk period of n months and $F(r,n)$ be the probability of not exceeding r pregnancies during the same risk period. As indicated already, $(m-1)$ measures the length of the immunity period and p designates the monthly likelihood of accidental pregnancy outside of immunity periods, with $q = 1-p$. Dandekar has shown, among other things, that

$$F(0,n) = q^n,$$
$$F(1,n) = q^{n-m}\,[1+(n-m)\,p] \text{ and}$$
$$F(2,n) = q^{n-2m}\left[1+(n-2m)\,p+\frac{(n-2m)(n-2m+1)}{2}\,p^2\right],$$

provided that $(n-2m) \geq 0$. Furthermore,

$$P(0,n) = F(0,n),$$
$$P(1,n) = F(1,n) - F(0,n) \text{ and}$$
$$P(2,n) = F(2,n) - F(1,n).$$

Finally use will also be made of the relationship

$$P(3 \text{ or more}, n) = 1 - F(2,n).$$

It follows from the formulas that the longer the immunity

period of $(m-1)$ months, the greater the monthly likelihood of accidental pregnancy, or p, can be and still obtain the same chance $F(x,n)$ of not exceeding x pregnancies, provided of course that the risk period of n months is kept constant. For purposes of this paper, it is desirable to overestimate, rather than underestimate, the immunity period lest exaggeratedly low monthly risks of pregnancy be calculated as necessary to achieve stated degrees of long range protection. A value of 18 is assigned $(m-1)$, providing for 9 months of pregnancy and 9 months of postpartum amenorrhea and anovulatory cycles. Almost certainly in the United States as a whole the average immunity period falls short of 18 months.[11] Fortunately the formulas are rather insensitive to the value assigned $(m-1)$ as long as $(m-1)/n$ and p are both small.

[11] It is fairly generally agreed that: (1) after childbirth there ensues a period of amenorrhea, usually followed by one or more anovulatory menstrual cycles; and (2) the length of this period of temporary sterility varies greatly among women and, for a given woman, tends to be longer the longer she nurses her infant. Documentation comes from several investigations. In 1940, R. K. Stix reported mean durations of amenorrhea of 4.5, 4.9, and 6.1 months in three large samples averaging 6.0, 7.8, and 9.8 months of lactation in "Factors Underlying Individual and Group Differences in Uncontrolled Fertility," *Milbank Memorial Fund Quarterly*, July, 1940, xxviii, p. 256. Peckham recorded averages of 5.1 and 5.6 months of amenorrhea for an unspecified division of 2,885 patients into groups averaging 7.8 and 8.9 months of lactation respectively. These data are cited in Guttmacher, A. F.: Fertility of Man, *Fertility and Sterility*, May–June, 1952, III, pp. 284–285. To the writer's knowledge, there exists no large scale survey of amenorrhea among nonlactators, though fragmentary evidence, based on medical practices, suggests that its duration averages well under 4.5 months. A. Sharman's review of the literature and his own data indicate that nonlactators may average in the neighborhood of two anovulatory cycles once menstruation is resumed, while lactators average more, "Ovulation After Pregnancy," *Fertility and Sterility*, Sept.–Oct. 1951, II, pp. 371–393. In his model of fecundity, A. F. Guttmacher posits an average of 2 months of amenorrhea and 2 months of anovulatory cycles for nonlactators as opposed to 6 and 3 months for lactators, though he does not state what lengths of lactation he is assuming (*op. cit.*, pp. 284–286). From the above results, one infers that if a population of mothers are lactating an average of less than 6 months, then amenorrhea will average under 4.5 months, to which must be added an expectation of perhaps 3 or 4 anovulatory cycles, so that total postpartum sterility averages under 9 months.

A national sample of British mothers in 1946 were found to nurse their infants on the average of 4.2 months, Douglas, J. W. B.: The Extent of Breast Feeding in Great Britain in 1946 With Special Reference to the Health and Survival of Children. *Journal of Obstetrics and Gynecology of the British Empire*, 1950, 57, pp. 339–340. No comparable study exists for the United States in recent years, but there is little reason to believe that residents of this country nurse much longer on the average than British women. On this premise, the average length of postpartum sterility in this country is established as well under 9 months.

Protection During Risk Period	Length of Risk Period	
	Ten Years	Fifteen Years
No Pregnancies	.0004	.0003
One Pregnancy or Less	.0035	.0022
Two Pregnancies or Less	.0098	.0057

Table 2. Monthly risks of accidental pregnancy yielding .95 assurances of specified levels of protection during risk periods of 10 and 15 years, assuming immunity periods of 18 months.

Results

What are the monthly risks of accidental pregnancy which must be maintained in order to have a .95 chance of not exceeding 0, 1, or 2 pregnancies during risk periods of 10 or 15 years? The results, predicated on Dandekar's model and an immunity period of 18 months, are given in Table 2. Even to be 95 per cent sure of not exceeding two pregnancies in a risk period of 10 years requires that couples keep the monthly risk of contraceptive failure below .01. Thus efficient contraception is required not merely for complete protection but for a reasonable certainty of staying under three excess pregnancies.[12] The requirements are much more stringent for risk periods lasting 15 years.

In a recent survey, representing a specialized probability sample of urban two-child families, the pregnancy rate during contraception was found to average over .025 when the experience of each couple was weighted equally so as to obtain a simple mean of individual accident rates.[13] A similar result was obtained from the Indianapolis Study.[14] Short marriage

[12] If a value of 12 is substituted for (m-1), in place of 18, the requisite monthly risks of contraceptive failures decrease very slightly. For example, for risk periods of 10 years, values of .0004, .0033, and .0084 are obtained, in contrast to values of .0004, .0035, and .0098 appearing in Table 2.

[13] Potter, R. G.: Contraceptive Practice and Birth Intervals among Two-Child White Couples in Metropolitan America. *In* Thirty Years of Research in Human Fertility: Retrospect and Prospect. New York, Milbank Memorial Fund, 1959, p. 76.

[14] Potter, R. G.: Length of the Observation Period as a Factor Affecting the Contraceptive Failure Rate. The Milbank Memorial Fund *Quarterly*, April, 1960, xxxviii, No. 2, pp. 148–149.

Length of Risk Period	Number of Excess Pregnancies			
	0	1	2	3 or More
10 Years	.05	.23	.38	.34
15 Years	.01	.07	.21	.71

Table 3. Probabilities of excess fertility during risk periods of 10 or 15 years, when the monthly chance of accidental pregnancy is .025, assuming that each conception is followed by an immunity period of 18 months.

durations have such a large weight in these findings that it is not certain whether the accident rate declines or not after attainment of desired family size. Nevertheless it is of interest to consider the long range consequences of a monthly pregnancy rate as high as .025.

Just how poor is the protection secured from contraception when it allows a .025 monthly chance of pregnancy is shown in Table 3. With risk periods of 10 years, few couples gain complete protection; a majority experience one or two pregnancies; and one-third may anticipate three pregnancies or more.[18] When the risk period is 15 years, a majority have to expect three or more pregnancies.

Discussion

Upon first reflection, one might suppose that very efficient contraception would be needed for complete protection during a long risk period, but that mediocre contraception, say holding the monthly likelihood of pregnancy down to 2 or 3 per cent, would seldom exact a penalty greater than one or two unsought pregnancies. Yet the previous section has shown that such mediocre contraception generates a very real risk of exceeding three pregnancies in a risk period of 10 years.

A corollary of this result is that even occasional omissions of contraception during a long risk period may lead to as many

[18] Here because p is as large as .025, substitution of 12 instead of 18 for (m-1) does moderately affect the probabilities of excess pregnancy. For example, with (m-1) set equal to 12, the top row of Table 3 would show .05, .20, .32, and .43 as the probabilities respectively of 0, 1, 2, and 3 or more pregnancies in a 10-year risk period.

as three excess pregnancies. As simplifying assumptions, assume that times of chance-taking are distributed randomly over the menstrual cycle; that contraception is foolproof when used; and that in the absence of contraception during an entire menstrual cycle, chances of pregnancy are .33.[16] Under these artificial conditions, a .075 rate of chance-taking suffices to yield a .025 monthly risk of accidental pregnancy. In other words, it does not take frequent chance-taking, but an omission rate less than one in ten, to yield an appreciable chance of exceeding three excess pregnancies in a risk period of 10 years or longer. Of course, the danger is less if the couple recognize the middle of the month as the most fertile time and regulate their chance-taking accordingly; but by the same token, the danger is all the greater if the couple are guided by incorrect information about the menstrual cycle.

[16] The figure of .33 comes close to the estimate of .34 used by Tietze, C.: Differential Fecundity and Effectiveness of Contraception. *The Eugenics Review*, January, 1959, 50, No. 4, p. 232.

CONTINUITIES IN THE DECLINING FERTILITY OF THE JAPANESE

IRENE B. TAEUBER*

IN 1925, Japan's people were predominantly agricultural and rural. The birth rate was in the upper thirties; the gross reproduction rate[1] was 2.6. Presumably fertility had been higher in the past, for the rates of marriage and childbearing among women were related both to the urbanization of their areas of residence and to the occupations and the educational levels of their husbands. Presumbly fertility would continue to decline slowly along with increasing urbanization, advancing industrialization, and higher educational levels. In fact, economic growth and social change were rapid in the years after the Pacific war, and declines in fertility were even more rapid. In 1955, the birth rate was below 20, while the gross reproduction rate was 1.1. The ratio of births to women in the childbearing ages was less than half its level a generation earlier.

The path of this decline in the fertility of the Japanese is difficult to trace empirically or to assess theoretically. The levels of fertility and the data that measure it were alike related to political and economic events. In the years from 1925 to 1937 there were regularities in the changes in fertility and in the developments in statistics. From 1940 to 1950 there were many statistical activities, but publication was limited. In 1955, numerators from vital statistics and denominators from census tabulations permit the computation of age-specific total and marital fertility rates for the women of the prefectures. Thus it is possible to contrast the fertility of the women in the prefectures in 1925 and in 1955.

The childbearing of the women in 1925 occurred in the tra-

* Office of Population Research, Princeton University.

[1] As conventionally used, the gross reproduction rate is the average number of daughters that a cohort of newly-born females would have if, as they pass through life, they were subject to the age-specific fertility rates of a given date, and if all survive the childbearing ages.

ditional Japan of the pre-Manchurian years. The childbearing of the women in 1955 occurred in a period of rapid economic growth after a decade had lessened many of the influences of war. The differences between these two years permit comparisons of the fertility of Japanese women who were separated from each other by a generation. Interpretations of the results of the comparisons in terms of the processes of fertility decline must be cautious, for the actual course of the declines is known only in broad outline, and the course that the decline would have followed in more normal circumstances cannot be determined. It is not possible to determine what fertility would have been in 1955 in the absence of war and defeat. Given war and defeat, it is not possible to determine the relation between the actual developments in fertility over the last fifteen years and those that would have occurred if there had been no legalization of abortions. Projections of prewar trends and other manipulations of the data indicate the magnitude of the fluctuations and the extent and rapidity of the declines in the years from 1949 to 1955, but such projections do not indicate the fertility that would have been expected in the absence of imperial expansion and war. The demographic facts of size and growth in 1925 alone precluded the orderly and slow transformations of the population over a period of many decades or even a century or so. They did not determine a specific direction of movement for government, economy, migration, or future population growth.

The present note involves comparisons of the levels and the differentials in fertility mainly in 1925 and in 1955, with emphasis on the narrowing or the widening of the differences and the shifts in the relations of age and marital status to reproduction. The areas that are utilized include prefectures, industrial groupings of prefectures, and rural and urban areas.

All Births to All Women

The outstanding fact in the changing fertility of the Japanese over the last generation is decline. The picture is apparent in

Table 1. The fertility of women in the prefectures of Japan, 1925, 1947, and 1955.

Regions and Prefectures	Births per 1,000 Population			Gross Reproduction Rates			Female Births per 1,000 Women Aged 15 to 49		
	1920–1925[a]	1947	1955[a]	1925	1947	1955[d]	1925	1947	1955[d]
Japan	36.7[b]	34.3	19.4	2.6	2.2	1.1	75.7[b]	64.9	36.2
Hokkaido	43.3	36.8	21.7	3.2	2.4	1.3	92.6	69.8	41.9
Tohoku									
Aomori	44.8	41.5	25.5	3.2	2.6	1.5	94.6	78.6	47.8
Iwate	42.1	36.5	24.3	3.0	2.6	1.4	88.0	71.8	45.3
Miyagi	41.6	35.4	22.3	3.1	2.2	1.3	90.0	67.8	41.4
Akita	43.4	38.0	22.5	3.2	2.4	1.3	92.7	72.5	41.2
Yamagata	40.5	32.8	20.2	2.9	2.1	1.2	83.7	60.2	36.6
Fukushima	40.3	35.7	23.4	3.0	2.2	1.5	85.0	67.8	45.2
Kanto									
Ibaraki	38.8	34.3	21.6	2.9	2.2	1.4	82.5	65.6	42.2
Tochigi	40.7	35.7	21.6	3.0	2.3	1.3	85.8	67.9	40.6
Gumma	38.3	34.7	20.0	2.6	2.2	1.2	74.8	64.4	36.6
Saitama	38.5	36.8	21.1	2.7	2.3	1.3	76.6	69.3	38.4
Chiba	35.5	34.8	19.8	2.7	2.2	1.2	75.8	65.6	36.8
Tokyo	34.4	31.7	15.9	2.2	1.8	0.9	66.1	54.6	28.1
Kanagawa	36.6	33.9	17.7	2.6	2.4	1.0	78.9	63.4	32.5
Chubu									
Niigata	38.2	35.4	20.8	2.8	2.2	1.3	80.0	67.9	38.7
Toyama	38.9	42.2	18.1	2.9	2.6	1.0	82.7	78.2	32.4
Ishikawa	35.6	40.1	18.7	2.6	2.5	1.1	72.8	73.8	34.2
Fukui	37.4	34.9	19.7	2.8	2.1	1.2	77.8	63.9	36.8
Yamanashi	37.6	32.6	19.4	2.9	2.1	1.3	81.7	63.0	37.3
Nagano	34.6	30.0	17.6	2.5	1.8	1.1	69.1	55.7	33.3
Gifu	37.9	34.3	18.5	2.8	2.1	1.1	79.8	64.8	34.8
Shizuoka	39.2	34.6	20.5	2.9	2.1	1.2	82.4	64.8	37.8
Aichi	36.5	33.4	17.3	2.5	2.0	1.0	71.0	60.6	31.2
Kinki									
Mie	35.9	32.6	17.1	2.6	2.0	1.0	73.7	59.0	32.1
Shiga	33.7	30.1	17.6	2.5	1.9	1.1	68.7	54.5	32.2
Kyoto	32.0	31.0	14.4	2.1	1.9	0.9	60.2	53.5	26.6
Osaka	34.0	31.2	15.9	2.0	1.9	0.9	59.0	52.2	29.9
Hyogo	34.9	32.0	17.2	2.2	2.0	1.0	65.4	56.2	32.6
Nara	34.9	30.8	16.8	2.4	1.8	1.0	68.0	53.1	31.1
Wakayama	33.9	32.0	17.3	2.4	1.9	1.0	67.4	57.6	31.8
Chugoku									
Tottori	34.2	32.8	19.4	2.6	1.7	1.2	72.4	57.3	37.2
Shimane	32.6	36.4	18.5	2.5	2.3	1.2	70.6	68.3	37.4
Okayama	31.0	33.0	16.9	2.2	2.1	1.0	61.9	60.2	32.3
Hiroshima	34.6	33.7	17.5	2.6	2.1	1.0	73.3	61.4	32.8
Yamaguchi	32.3	33.3	17.9	2.4	2.2	1.1	69.5	62.6	35.6

Table 1. (*Continued*).

Regions and Prefectures	Births per 1,000 Population			Gross Reproduction Rates			Female Births per 1,000 Women Aged 15 to 49		
	1920–1925[a]	1947	1955[a]	1925	1947	1955[d]	1925	1947	1955[d]
Shikoku									
Tokushima	35.3	37.0	20.5	2.7	2.3	1.2	76.0	69.3	39.1
Kagawa	36.6	37.3	17.6	2.6	2.3	1.1	74.9	67.2	33.2
Ehime	35.3	36.3	19.9	2.6	2.3	1.2	74.6	68.0	38.0
Kochi	33.8	33.8	18.2	2.4	2.1	1.1	71.6	61.0	33.8
Kyushu									
Fukuoka	36.2	34.1	19.8	2.4	2.2	1.1	71.3	62.0	36.8
Saga	36.5	34.7	22.9	2.6	2.2	1.4	75.1	64.1	43.2
Nagasaki	35.4	34.6	24.7	2.6	2.2	1.6	76.0	64.7	48.5
Kumamoto	34.8	34.6	22.2	2.6	2.2	1.4	74.4	64.3	42.8
Oita	35.3	34.3	20.7	2.7	2.2	1.3	74.6	63.7	39.1
Miyazaki	36.6	37.6	23.5	2.7	2.4	1.5	78.9	71.5	46.3
Kagoshima	37.2	33.6	24.5	2.7	2.1	1.6	78.5	62.7	49.0

[a] Adjusted for under-enumeration and mal-distribution on the basis of enumerated children aged 0.
[b] Including Okinawa.
[c] Calendar year 1955.
[d] Average births of 1955 and 1956 related to enumerated populations as of Oct. 1, 1955.
Sources of data: For births: Nihon. Naikaku tōkei-kyoku. *Jinkō dōtai tōkei*, 1920–1925. Kōseishō, eisei tōkei-bu. *Jinkō dōtai tōkei*, 1947–1957. Also, for 1925, Naikaku tōkei kyoku. *Fubo no nenrei betsu shussei tōkei. Taishō 14-nen.* For populations and ages of women: Nihon. Naikaku tōkei-kyoku. *Taishō jūyo'nen kokusei chōsa hōkoku*, II, 4, Parts 1–46. Nihon. Sōri-fu, tōkei kyoku. *Shōwa 22-nen rinji kokusei chōsa kekka hōkoku*, Sono 7, *Nenrei betsu jinkō*. Nihon. Sōri-fu, tōkei-kyoku. *Shōwa 30-nen kokusei chōsa hōkoku*. 1955 Population Census of Japan. Vol. II, Part I, Statistical table 5.

crude birth rates, but the outlines are more incisive in gross reproduction rates and in ratios of births to women in the childbearing ages (Table 1). Even a postwar baby boom such as that in process in 1947 failed to lift current birth rates to the levels of 1925 except in an occasional prefecture.

The ratios of births to women in the childbearing ages were substantially lower in 1947 than they had been in 1925, Ishikawa alone showing an increase, and that an insignificant one. Percentage declines amounted to less than 10 in eight of the prefectures. Declines of 10 to 19 per cent occurred in 24 prefectures, declines of 20 per cent or more in 13 prefectures. This, it should be emphasized, is a comparison of fertility ratios for a year of unusual concentration of first births and of births to re-united couples with a normal year in the mid-'twenties. Furthermore, it is a postwar year prior to the legalization of abor-

tion and the public health education for planned parenthood through contraception.

For all Japan, the ratio of births to women in 1955 was less than half that in 1925. Decline amounted to less than 45 per cent for five prefectures, to 55 per cent or more for 11. So great were the declines that there was no overlap in the distributions of gross reproduction rates or birth-women ratios for the prefectures in 1925 and in 1955.

There were major continuities in the relative levels of fertility in the prefectures from the beginning of the census period in 1920 to 1955. Linear correlations of gross reproduction rates in successive census years were above .9 until 1943. The correlation of the 1943 rates with those for 1947 was .7; the correlation of the 1947 rates with those for 1950 was .6. The correlations were .8 for 1920 and 1935, .9 for 1935 and 1950.

Thus there were drastic declines in fertility, but there were also persistent relations in the levels of fertility in the prefectures at succeeding periods of time. The variations among the prefectures were appreciable in 1925, and they remained appreciable in 1955. The level of fertility was lowered, but the prefectures maintained their relative positions with reference to each other. Thus the forces of stability that underlay reproductive behavior must have involved institutions and values that specified families and children, but not numbers of children. The altered economic, social, and psychological conditions that were responsible for the altered levels of childbearing must have been nation-wide rather than local; they must have influenced the peoples in remote rural areas as well as those in great cities. However, it does not seem likely that responses of reproductive behavior either to slowly changing or to sharply altered conditions, values, and aspirations would be uniform among all groups and in all areas.

In general, the initial impact of economic development and urban growth is greatest on those who labor in industry and live in cities. Among the Japanese, it was the people in the great cities who responded first and farthest with delayed mar-

riages and reduced fertility among the married. By 1925, however, the increasing productivity in agriculture, the migrations of rural youth to cities, the extension of school attendance, and other changes were transforming life in the most remote of the villages as in those close to cities. Levels of fertility in the prefectures in 1925 were measures of the relative participation of the people in the newer segments of the economy and the development in the larger society. In the succeeding years, the quantitative impact of changing conditions on age at marriage and rate of childbearing was greatest in the areas that were most agricultural in ways of working and most traditional in institutions and values.

In the slowly changing conditions of the years from 1925 to 1935, declines in fertility were roughly proportional to initial levels. There were disturbances in the years when urban peoples fled to the countryside, but on the whole the greater declines of fertility during the war years occurred in the areas where fertility remained relatively high. Convergence toward a national level of fertility that characterized all the people was especially pronounced in the years of rapid decline after the war. None the less, the differences among the prefectures that had been so substantial in 1925 and 1935 remained so in 1947 and 1955. Convergence was in process, but uniformity was not yet an achievement.

The regularities in the responses to altered conditions and values extended not only to the general level of fertility but to the incidence of the lower fertility in the reproductive years of the women. Later ages at marriage reduced the childbearing of younger women and placed the first births of the newly married in higher age groups. Childbearing had never been appropriate among older women, especially those who had achieved the status of mother-in-law. Throughout Japan, the reductions in fertility among the younger and the older women were so pronounced that they seemed to tend toward the elimination of childbearing among women below age 20 or above age 40. The major irregularities among the prefectures involved the

extent and the timing of the reductions in fertility among women in the central reproductive years.

The preceding generalizations on the age structures and the age-specific declines in fertility could have been deduced from the developments of the prewar years alone. They remain valid when the time span includes the prewar, the war, and the postwar years. In fact, the regularities in decline and the convergences in levels were greater in the postwar years of rapid decline than they had been in the prewar years of slow change. The correlations of the amounts of decline in age-specific birth rates and initial levels are given here for the prefectures for selected years:

Age	*1925–1955*	*1925–1947*	*1947–1955*
15–19	.99+	.97	.97
20–24	.64	.24	.80
25–29	.61	.67	.52
30–34	.52	.72	.26
35–39	.73	.45	.65
40–44	.92	.41	.92
45–49	.99+	.95	.99

The persistent differences among the prefectures in levels of childbearing were associated with the occupational structure of the labor force and the predominance of city versus town or village living. In Table 2, age-specific birth rates per 1,000 women are given for 1955, the prefectures being grouped according to the proportion of the employed labor force in primary industry. The lowest birth rates at each age were in Group I, which included Tokyo and Osaka prefectures; the highest were in Group VI, which included the most agricultural prefectures in northeast Honshu and southeast Kyushu. In general, increases in fertility occurred along with increases in the predominance of primary industry. This relationship, so apparent in 1955, had also characterized the childbearing of women at each of the earlier census periods. Declines from 1925 to 1955 reduced the range of variation, but the similarities among the

prefectures in the amount and the age incidence of the declines were more striking than the differences.

From 1925 to 1955, advancing age at marriage reduced childbearing among those aged 15 to 19 to very low levels and

Table 2. Births per 1,000 women by age, industrial groupings of prefectures, 1955 and change since 1925.

Ages of Women	Japan	Prefectures by Per Cent of Labor Force in Primary Industry, 1955[a]						Hokkaido (42)
		I (Below 10)	II (10–29)	III (30–44)	IV (45–54)	V (55–59)	VI (60 or Over)	
				1955[b]				
15–49	74.4	59.4	67.0	71.5	76.9	80.6	92.3	86.3
15–29	5.6	3.5	4.8	5.3	5.9	6.1	9.0	6.9
20–24	112.2	76.3	102.5	121.0	117.6	121.6	142.2	133.4
25–29	183.6	152.8	171.2	181.0	191.2	196.9	208.8	207.7
30–34	110.4	88.1	96.2	98.2	118.2	124.8	140.8	114.4
35–39	47.7	34.8	38.0	37.5	51.7	54.9	72.2	55.6
40–44	11.9	7.9	8.4	8.7	12.6	13.5	21.5	17.5
45–49	0.7	0.5	0.5	0.5	0.7	0.7	1.3	1.4
				Change since 1925: amount				
15–49	−79.6	−69.2	−73.8	−80.7	−76.2	−77.6	−82.3	−102.1
15–19	−43.2	−27.6	−33.0	−45.4	−40.7	−44.2	−67.1	−67.4
20–24	−125.4	−105.0	−116.4	−134.4	−122.4	−125.6	−132.5	−165.3
25–29	−83.4	−72.0	−75.4	−83.9	−81.0	−83.1	−83.2	−90.0
30–34	−124.6	−107.4	−118.6	−129.9	−123.5	−120.2	−111.5	−148.1
35–39	−133.0	−110.9	−125.8	−132.2	−135.1	−130.3	−120.1	−155.0
40–44	−66.2	−53.1	−61.0	−65.0	−67.4	−65.4	−64.0	−84.4
45–49	−12.5	−10.3	−11.1	−11.3	−11.1	−12.5	−18.3	−18.1
				Change since 1925: per cent				
15–49	−51.7	−53.8	−52.4	−53.0	−49.8	−49.1	−47.1	−54.2
15–19	−88.4	−88.8	−87.3	−89.6	−87.3	−87.9	−88.1	−90.7
20–24	−52.8	−57.9	−53.2	−52.6	−51.0	−50.8	−48.2	−55.3
25–29	−31.2	−32.0	−30.6	−31.7	−29.8	−29.7	−28.5	−30.2
30–34	−53.0	−54.9	−55.2	−57.0	−51.1	−49.1	−44.2	−56.4
35–39	−73.6	−76.1	−76.8	−77.9	−72.3	−70.4	−62.5	−73.6
40–44	−84.8	−87.0	−87.9	−88.1	−84.3	−82.9	−74.9	−82.8
45–49	−94.5	−95.7	−95.8	−95.4	−93.7	−94.5	−92.9	−92.6

[a] Prefectures classified according to the per cent of the employed labor force aged 15 and over in primary industry, 1955. By primary industry is meant agriculture, forestry, fishing, and mining.
[b] Births adjusted for under-enumeration and the omission of persons not in *koseki*, particularly Koreans.
Sources of data: References, note to Table 1.

Age	Legitimate Births per 1,000 Men		Per Cent Change
	1952	1957	
15–59	82.4	58.6	−28.9
15–19	1.1	0.3	−72.7
20–24	48.1	27.2	−43.4
25–29	189.0	155.9	−17.5
30–34	222.9	158.2	−29.0
35–39	152.4	81.7	−46.4
40–44	83.0	33.9	−59.2
45–49	33.2	12.7	−61.7
50–54	9.7	3.9	−59.8
55 and Over	3.6	1.6	−55.6

Table 3. Legitimate births per 1,000 men 1952 and 1957, and per cent change, by age.

halved the childbearing of those aged 20 to 24. Declines were least among those aged 25 to 29; here altered ages at marriage and altered rates of childbearing minimized declines but altered the relation of the age-specific to the expected completed fertility of the women. The greatest absolute declines in births occurred among women aged 30 to 39; relative declines amounted to one-half at ages 30 to 34, three-fourths at ages 35 to 39. Above age 40, childbearing was limited severely. Reductions averaged 85 per cent at ages 40 to 44, 95 per cent at ages 45 to 49.

The preceding analysis of declining fertility has been presented exclusively in terms of births to women, a limitation dictated by the availability of data. The intricacies of the changes would have differed somewhat if a comparable analysis had been made for men. Internal and imperial migration, military mobilization, and war produced temporary or permanent deficits of men. However, the altered balance of the sexes has been a minor factor in the declines of the last decade; in so far as there was an influence, the aging of decimated cohorts of men contributed to increasing marriage and increasing fertility among women in the central childbearing years.

The direct evidence for the years from 1952 to 1957 indicates continuously declining age-specific birth rates for men. The rate for the years 1952 and 1957 are given in Table 3 with the percentage changes for this five year period.[2]

The halving of general fertility from 1925 to 1955, the widely variant declines among the age groups of women, and the continuities in relations among the prefectures characterized the total childbearing of women without reference to the legitimacy of the births or the marital status of the women. In order to determine the priorities and interrelations of changing marital status and changing practices of limitation among the married, it is necessary to examine the initial levels and the course of change in the legitimate fertility of married women.

Legitimate Births to Married Women

In 1955, the regularities in the associations of the legitimate fertility of married women with the industrialization of the prefectures of residence were even greater than those for the total fertility of all women. For each age group of married women, and for all married women aged 15 to 49, the number of legitimate births per 1,000 women was lowest in the metropolitan prefectures of Tokyo and Osaka, highest in the most agricultural prefectures (Table 4). The relative penetration of the new economy and society was reflected directly in the childbearing of the married. Advancing ages at marriage and family limitation within marriage were associated rather than independent variables in the reproductive performance of the women in the geographic areas and social-economic groups in 1955.

The overall declines in marital fertility from 1925 to 1955 corresponded closely to those in total fertility except that the amounts of the declines were somewhat smaller. Altered marital status had been a factor, although a minor one, in the declines in the general levels of fertility over the course of this generation. However, the changes in marital fertility by age were

[2] Source of data: Nihon. Kōsei-shō, eisei tōkei-bu. *Jinkō dōtai tōkei*, annually, 1951–1957, Vol. 1.

strikingly different from those in total fertility. For all Japan, there were increases in marital fertility at ages 15 to 19 and 20 to 24. Little significance can be attached to the increases at ages 15 to 19, for the numbers married at these ages in 1955

Table 4. Legitimate births per 1,000 married women, by age, industrial groupings of prefectures, 1955 and change since 1925.

Ages of Women	Japan	Prefectures by Per Cent of Labor Force in Primary Industry, 1955[a]						Hokkaido (42)
		I (Below 10)	II (10-29)	III (30-44)	IV (45-54)	V (55-59)	VI (60 or Over)	
				1955[b]				
15-49	127.4	109.0	116.8	120.2	129.1	136.0	153.8	143.2
15-19	327.3	277.3	302.8	314.6	325.3	342.1	345.0	436.5
20-24	338.6	304.2	327.3	338.1	336.6	354.3	355.2	369.7
25-29	237.0	222.0	226.1	225.8	238.6	250.0	256.6	249.4
30-34	127.4	107.6	112.2	112.3	134.0	142.4	160.3	126.1
35-39	56.4	41.6	44.9	44.8	61.0	64.6	85.6	62.0
40-44	14.6	9.7	10.3	10.9	15.4	16.6	26.6	20.3
45-49	0.9	0.6	0.6	0.7	0.9	0.9	1.8	1.7
				Change since 1925: amount				
15-49	−87.6	−82.7	−85.9	−90.8	−87.5	−86.6	−85.4	−101.5
15-19	7.9	23.0	6.9	−9.7	2.0	−3.3	4.9	92.1
20-24	2.9	23.6	11.9	−3.1	−10.8	−4.7	−9.1	8.9
25-29	−56.3	−32.5	−48.0	−64.6	−64.2	−62.6	−67.3	−61.4
30-34	−122.6	−105.3	−119.6	−133.1	−126.7	−122.6	−115.1	−141.8
35-39	−136.8	−119.0	−133.7	−140.2	−143.4	−138.1	−127.8	−153.6
40-44	−72.1	−60.1	−69.1	−72.4	−75.2	−73.7	−72.6	−87.6
45-49	−14.6	−12.5	−13.2	−13.2	−13.0	−15.0	−22.5	−20.2
				Change since 1925: per cent				
15-49	40.8	−43.1	−42.4	−43.0	−40.4	−38.9	−35.7	−41.5
15-19	2.5	9.0	2.3	−3.0	.6	−1.0	1.4	26.8
20-24	.9	8.4	3.8	−0.9	−3.1	−1.3	−2.5	2.5
25-29	−19.2	−12.8	−17.5	−22.2	−21.2	−20.0	−20.8	−19.7
30-34	−49.0	−49.5	−51.6	−54.2	−48.6	−46.3	−41.8	−52.9
35-39	−70.8	−74.1	−74.9	−75.8	−70.2	−68.1	−59.9	−71.2
40-44	−83.2	−86.1	−87.1	−87.0	−83.0	−81.7	−73.2	−81.2
45-49	−94.2	−95.6	−95.5	−95.1	−93.4	−94.3	−92.7	−92.1

[a] Prefectures classified according to the per cent of the employed labor force in primary industry, 1955.

[b] Total births minus illegitimate births, the latter assumed to have the same distribution by age of mother as all births.

Sources of data: References, note to Table 1.

were so few that they represented a stringent selection from the general population. In the modal ages of legitimate fertility, roughly ages 20 to 34, the frequency of childbearing was reduced least in the earlier years, most in the later years. Numbers of legitimate births per 1,000 married women either increased or declined slightly for women aged 20 to 24. There was a reduction of one-fifth for women aged 25 to 29, a reduction of one-half for women aged 30 to 34. Relative declines became progressively greater with the advancing ages of the women until they amounted to more than ninety per cent for women aged 45 to 49. If married women aged 15 to 19 are ignored, the rate of change increased progressively from small increases or decreases at ages 20 to 24 to the virtual cessation of childbearing at ages over 40. The process was clearly the limitation of higher order births rather than the avoidance or even the substantial postponement of first births.

Fertility in the *SHI* and the *GUN*[3]

In Japan, there were close associations among nonagricultural occupations, life in cities, age at marriage, and childbearing among the married. In the years from 1925 to 1937 the highest ages at marriage and the lowest fertility among the married occurred in the six great cities. There were progressive increases in fertility from the cities of 100,000 and over to the lesser cities, the *machi*, and the *mura*. At any given time, there were high correlations between the fertility in the *shi* and the *gun* of the prefectures.

In the prewar years, the fertility of the women in a given area was related directly to the extent of the dependence of its population on primary industry. These relations, too, persisted in the postwar years. In 1955, fertility was lower in the cities of 200,000 and over than in all *shi*, and it was lower in the *shi* than in the *gun* (Table 5). The range in gross reproduction rates

[3] The terms *shi* and *gun* are often translated as urban and rural. *Shi* are incorporated municipalities, most of which have populations of 50,000 or more. All the population not in *shi* live in *gun*. Thus much of the population that would be considered as urban in the United States live in *gun*, rather than *shi*.

extended from .85 in the cities of 200,000 and over in the most industrial prefectures to 1.58 in the *gun* of the most agricultural prefectures. In fact, the fertility of the women in the *shi* of the most agricultural prefectures was higher than that of the women in the *gun* of the most industrial prefectures.

Since there were substantial differences in marital status between the women of the *shi* and the *gun*, the childbearing of women in 1955 is examined separately for total and for married women (Table 6). In each industrial grouping of prefectures, the ratio of children below age one to women aged 20 to 34 was lowest in the cities of 200,000 and over, intermediate in the smaller *shi*, highest in the *gun*. For any given type of area of residence, fertility was lowest in the most industrial prefectures, highest in the most agricultural prefectures. These relationships held both for the ratios of infants to all women and for the ratios to married women.

Uniformities in Change, 1951 to 1957

In 1955, general fertility was less than half what it had been a generation earlier, marital fertility 40 per cent less. It is apparent that declines such as these could have been achieved only

Table 5. Gross reproduction rates, the *shi* and the *gun* in industrial groupings of prefectures, 1955.[a]

Prefectures by Per Cent of Labor Force in Primary Industry, 1955	All Japan	*Shi*		*Gun*
		Total	200,000 and Over	
Japan	1.15	1.01	.90	1.36
I (Below 10)	.88	.86	.85	1.07
II (10–29)	1.02	.95	.91	1.23
III (30–44)	1.10	1.01	.96	1.20
IV (45–54)	1.21	1.09	1.04	1.33
V (55–59)	1.26	1.10	.95	1.39
VI (60 and Over)	1.46	1.27	1.10	1.58
Hokkaido (42)	1.30	1.10	.94	1.48

[a] Births, 1955 and 1956, related to enumerated populations as of October 1, 1955.
Sources of data: Nihon. Sōri-fu, tōkei kyoku. *Shōwa 30-nen kokū sei chōsa hōkoku. 1955 Population Census of Japan.* Vol. V, Parts 1–46, Statistical table 2. Nihon. Kōsei-shō, eisei tōkei-bu. *Jinkō dōtai tōkei*, 1955 and 1956, Vol. 1.

if there had been major reductions in the frequency of upper-order births among large portions of the families. Information on order of birth is not available for the prewar years, but it is available for the prefectures for the years from 1951 through 1957. In these years there were continuing increases in the proportion of all births that were first births, continuing reductions in the proportion that were fourth or higher order births (Table 7). Again, the changes were occurring in all industrial groupings of prefectures, from metropolitan Tokyo and Osaka to the prefectures most heavily dependent on primary industry.

Table 6. Children below age 1 per 1,000 women aged 20 to 34, all women and married women in the *shi* and the *gun*, industrial groupings of prefectures, 1955.

Prefectures by Per Cent of Labor Force in Primary Industry, 1955	All Japan	*Shi*			*Gun*
		Total	200,000 and Over	Below 200,000	
	ALL WOMEN				
Japan	151	132	117	145	179
I (Below 10)	113	110	109	118	147
II (10–29)	135	125	121	135	162
III (30–44)	145	133	127	136	160
IV (45–54)	161	144	138	145	177
V (55–59)	166	145	121	148	184
VI (60 or Over)	189	164	141	167	206
Hokkaido (42)	171	145	123	156	194
	MARRIED WOMEN				
Japan	240	220	204	237	267
I (Below 10)	205	202	200	217	241
II (10–29)	221	210	203	226	250
III (30–44)	224	213	206	217	236
IV (45–54)	248	231	223	233	264
V (55–59)	258	237	215	241	274
VI (60 or Over)	281	258	261	258	296
Hokkaido (42)	257	223	209	230	285

Source of data: Nihon. Sōri-fu, tōkei kyoku. *Shōwa 30-nen kokūsi chōsa hōkoku. 1955 population census of Japan.* Vol. V, Parts, 1–46, Statistical table 2.

Table 7. Per cent distribution of births by order, prefectures in industrial groupings, 1951, 1953, 1955, and 1957.[a]

Prefectures by Per Cent of Labor Force in Primary Industry, 1955	All Births	First	Second	Third	Fourth to Sixth	Seventh or Higher
Japan						
1951	100	24.9	27.8	19.2	22.1	6.0
1953	100	28.1	25.5	21.4	21.0	4.0
1955	100	32.5	26.2	19.2	19.5	2.7
1957	100	36.9	29.3	16.7	15.3	1.9
I (Below 10)						
1951	100	29.0	29.4	19.1	19.4	3.1
1953	100	35.2	27.8	19.2	16.0	1.8
1955	100	41.4	28.6	16.2	12.6	1.2
1957	100	36.9	29.3	16.7	15.3	1.9
II (10–29)						
1951	100	26.4	28.2	19.9	21.2	4.3
1953	100	30.9	26.7	21.1	18.9	2.5
1955	100	36.1	27.8	18.3	16.1	1.6
1957	100	40.4	31.2	15.7	11.7	1.0
III (30–44)						
1951	100	25.7	29.4	19.2	20.9	4.9
1953	100	29.6	27.0	21.8	18.8	2.9
1955	100	34.1	27.7	19.3	17.0	1.9
1957	100	38.1	30.9	17.0	12.8	1.3
IV (45–54)						
1951	100	24.3	27.9	19.6	22.3	6.0
1953	100	27.0	25.3	22.0	21.8	3.9
1955	100	30.8	25.8	19.8	20.8	2.7
1957	100	34.4	28.9	17.5	17.2	2.0
V (55–59)						
1951	100	23.8	28.4	19.1	22.2	6.5
1953	100	25.9	25.2	22.5	22.1	4.3
1955	100	29.6	25.4	20.6	21.6	2.8
1957	100	33.5	28.5	18.2	17.8	2.0
VI (60 or Over)						
1951	100	22.8	25.6	18.4	24.1	9.2
1953	100	23.9	23.0	21.2	25.1	6.8
1955	100	26.8	23.1	19.6	25.5	4.9
1957	100	29.9	25.6	17.9	22.7	3.8
Hokkaido (42)						
1951	100	22.5	23.0	18.6	25.4	10.6
1953	100	25.9	22.5	19.2	25.0	7.4
1955	100	30.2	24.6	17.9	22.0	5.2
1957	100	35.9	27.6	16.3	16.7	3.5

[a] Live births by total birth order.
Source of data: Nihon. Kōsei-shō, eisei tōkei-bu. *Jinkō dōtai tōkei*. Annually, 1951 through 1957. Vol. 1.

The reductions in upper-order births were so rapid that the proportion of seventh or higher order births in the most agricultural prefectures in 1957 was little higher than that in Tokyo and Osaka prefectures in 1951.

In most prefectures, the proportion of all births that were first order increased consistently from 1951 to 1957. In the metropolitan prefectures, however, there were fluctuations similar to those of countries where fertility has long been low. First births were relatively less frequent in 1957 than in 1955, while upper order births were relatively more frequent. The changes were slight, for the concentrations of births in the lower orders were greater in 1957 than they had been in 1953.

In the distribution of births by order, as in the other measures of fertility, the characteristics of urban and rural populations differed according to the extent of the industrialization of the prefectures of residence. In 1953, the proportion of all births that were first or second declined consistently from the most industrial to the most agricultural prefectures, while the proportions of fourth or higher orders increased consistently.[4] This was true for the *shi* and the *gun*. Differences among the six great cities were slight, but the predominance of lower order births was greater in the large cities than in all *shi*.

The reductions in the fertility of the Japanese were consistent with the values and the codes of behavior of the family whose primary function was the continuity of the generations. More than fourth-fifths of all first-born legitimate births occurred to women who had been married less than two years. There were some indications of postponement of legitimate first births among women aged 25 to 34, but they were slight. The percentage of all legitimate first births that occurred within two years of marriage are summarized here by the ages of the mothers for recent years:[5]

[4] Numbers of live births by total birth order by age of mother were given for the *shi* and the *gun* in the prefectures for 1953. Nihon. Kōsei-shō, eisei tōkei-bu. *Jinkō dōtai tōkei. 1953.* Vol. 1.

[5] Source of data: Nihon. Nihon kōsei-shō, eisei tōkei-bu. *Jinkō dōtai tōkei.* Annually, 1951 through 1957. Vol. 1.

Age of Mother	*1951*	*1953*	*1955*	*1957*
All Ages	83.4	82.8	81.8	80.3
15–19	94.1	94.5	94.6	94.2
20–24	88.0	88.2	87.9	87.6
25–29	77.1	76.4	75.5	74.1
30–34	62.8	59.5	59.6	59.1
35 and Over	48.0	44.7	46.7	47.0

Advancing ages at marriage and severely limited childbearing that began after an initial birth in the early years of marriage produced an increasing concentration of childbearing within a brief period of married life. In 1957, more than 90 per cent of all legitimate births in Japan occurred to women aged 20 to 34. More than three-fourths occurred to women aged 20 to 34 who were married to men in the same or the next higher quinquennial age group. The major concentrations of legitimate births were those to women aged 25 to 29. The percentage of all legitimate births occurring to women in this modal age group married to men of the same or the next higher age group increased from 29.6 in 1952 to 34.8 in 1955 and 38.6 in 1957.

Thus conformity to modal behavior became increasingly prevalent in Japan during the years of rapid decline in the levels of the fertility.

Conclusions

If an analysis of the declining fertility of the Japanese had ended with the data for the year 1950, there would have been a series of firm conclusions. Fertility had changed slowly in the ways made familiar in analyses for other industrializing countries, but the preservation of a stable peasantry had retarded national declines in fertility. Furthermore, this study of the years from 1920 to 1950 would have concluded that war was simply a disturbance to long-run trends, that the major declines in fertility had been and would probably remain those associated with changes in rural-urban distribution, occupational composition, and marital status. The anticipations would have

involved continuing growth for many decades and very substantial multiplications of numbers before demographic transition was completed.

If analysis of the declining fertility of the Japanese had been undertaken for the postwar years only, the base line would have been the year 1947. Rates of decline could have been described appropriately as miraculous. No comparable experiences would have been found elsewhere. The outlook for other Asian countries would have had to involve the possibilities for demographic miracles, for it would have seemed that one had happened in Japan.

The analysis that has been summarized in this paper was made when comparable data were available for the long period of slow change and for the recent period of rapid change. The major technique utilized was the measurement of net change from 1925 to 1955, but there were sustaining analyses of relationships in levels of fertility throughout the period and of the form and incidence of the changes in the years from 1951 to 1957.

The substantative results need be summarized only briefly. Fertility declined rapidly over the period from 1925 to 1955. General fertility was reduced fifty per cent, marital fertility forty per cent. Declines extended from the metropolitan areas to the remote villages, and they tended to be greater where the initial level of the fertility was higher. There were convergences, but they were not sufficient to blur the intricate relations among industrialization, urbanization, and fertility. In 1955, as in 1925, the general and marital fertility of the total population and of its urban and rural components declined progressively from the most agricultural to the most industrial prefectures. Relationships at the relatively low levels of 1955 were similar to those at the relatively high levels of 1925.

The net declines in fertility between 1925 and 1955 and the annual changes between 1951 and 1957 alike proceeded in conformity with the changing institutions and the enduring values of Japanese culture. Advancing age at marriage remained the

major means for the reconciliation of income, aspirations, and the ideals of family life. Major portions of those who married had a child within two years. Birth rates for married women below age 25 were as high or even higher in 1955 than they had been in 1925. However, in all industrial groupings of prefectures, and in cities and rural areas within all groupings, there were sharply increasing proportions of first births, sharply declining proportions of higher order births. There were some evidences of increasing postponements of initial childbearing, but the evidences were limited, and they were found only in the great metropolitan populations. It was numbers of children rather than the role of marriage, family, and the child in Japanese culture that had changed.

The net declines in fertility between 1925 and 1955 and the annual declines in recent years are quite consistent with expectations of declining fertility derived from experience elsewhere. There were extraordinary economic and educational advances in Japan between the early 'twenties and the late 'fifties. The declines in fertility in the 'twenties and the 'thirties could be ascribed primarily to the structural changes involved in urbanization, industrialization, and marriage postponement. However, the rapidly increasing prevalence of urban life and industrial employment implied massive internal migration, and the continued lower fertility in urban areas and industrial regions meant that people reared as peasants were adopting whatever limitation practices were prevalent in the cities. Internal migration joined old and new within a single generation, and migrants formed continuing channels for communication and influence between cities and rural areas.

The plasticity of the reproductive mores of the Japanese was demonstrated early in the reduced and declining fertility of the populations of the great cities. The bases for rapid declines in the fertility of rural people may also be found in the continuing contacts of village people who had moved to cities and those who had remained in the villages.

The major unresolved problems in the declining fertility of

the Japanese do not concern either the magnitudes or the associations of the declines that have occurred. They concern the timing of the declines, or, more specifically, the sequence of slow declines over a period of decades and then precipitant declines within a few years. There are two foci for research. One involves the reasons for the long persistence of relatively high fertility in Japan, and particularly among its literate peasantry. The other involves the reasons for the sudden spread of rigid limitation practices throughout the entire population, and particularly the peasantry. The clues to the interpretation of the developments within Japan, and the question of the relevance of these developments to other Asian countries, lie in further analyses of the changing fertility of the agricultural population.

ANNOTATIONS

MY NAME IS LEGION[1]

This book, which represents the first of three volumes which are planned to report the findings of Stirling County, offers a psychopathological and social framework for the study of the etiology of psychiatric disorders. Dr. Leighton points out that the study is concerned with the effects of environment on psychiatric disorders rather than with the effects of disorders on society and culture. Considering the problems of definition and identification of psychiatric phenomena, the emphasis at present needs to be placed on disorder rather than on health.

The first few chapters offer an orientation to the various patterns of psychiatric disorder. The reader becomes familiar with the setting of a town in Stirling County where a successful farmer, who is a husband, father and son, develops an anxiety neurosis. This fictional case study makes it easy for the reader to get a concrete picture of the relationship of psychiatric disorders to environment.

In the second part of the book, the relation of psychiatric disorders and socio-cultural environment is presented. A very stimulating chapter is the one in which the author discusses his concept of sentiments. To a psychiatrist this chapter, which discusses simple sentiments as well as a complex of sentiments, is exceedingly valuable. It fills a gap in psychopathology, offering not only an understanding of socio-cultural influences on the individual but also stimulating possibilities for psychotherapeutic guidance. Each chapter has an excellent review of literature. The detailed discussions of the concept of sentiments of previous authors is especially worth while.

[1] Leighton, Alexander, H.: My Name is Legion. New York, Basic Books, Inc., 1959.

The third part of the book offers a plan for research. The author presents a concept of social disintegration as a basis for comparing communities. From such a point of view, French and English communities in this Nova Scotian county are compared. The cultural differences in these two groups of population are marked in Stirling County because of distinctive geographic boundaries. Stress factors become recognizable in the degree of disintegration of the community. The frequency of psychiatric disorders may be related to individual stress. It should become possible to determine to what extent the culture and degree of integration of a community make a difference to individual mental health.

This book, which offers a foundation for a theory of man in relation to culture, is well written and it is easy for the reader to obtain a grasp of the essential concepts of psychiatric disorder and the meaning in socio-cultural environment. The first volume of this three-volume study makes one wait impatiently for the remaining two volumes which will present in detail the socio-cultural environment and the analysis of the prevalent data.

The life in this beautifully-described county is one of quietude but to the discerning reader, from the beginning of the book, the stress of social forces becomes obvious; and increasingly so as he progresses in his reading. This slowly changing county was an excellent place to carry out basic investigations. However, the reader must keep in mind that he cannot merely transcribe the results of this study to another group, e.g., in various parts of the United States. Some of the fundamental findings, presented by Dr. Leighton, remain the same for human beings living anywhere. Other findings will apply to people in similar cultures only, and still others, to people in rural settings. Finally, a large group is pertinent to Stirling County. At the present state of our knowledge, it is most difficult to single out these data in their correct evaluation. This knowledge will, however, be essential for the broad conclusions which can be used for the planning of improving mental health. Without such knowledge, all planning will remain on the basis of clinical psychiatric knowledge with the inherent danger of hazardous generalizations.

Dr. Leighton's knowledge of psychiatry, sociology and cultural anthropology, and his broad interests in and activity with individuals and groups in rural and urban society, and in intercultural relations, should make his future contributions most valuable. We should therefore expect him to increase our fundamental knowledge about the etiology of psychiatric disorders and their prevention.

OSKAR DIETHELM, M.D.

• • •

PEOPLE, JOBS AND ECONOMIC DEVELOPMENT[1]

THE title of this volume, which is a case history of Puerto Rico, has been most happily chosen. It exactly describes the author's interests and the kinds of material that he presents for this particular underdeveloped area. His basic tenet is that "the most significant economic growth is that which affects the individuals of the Nation" (p. 5). It is essential, therefore, that the increase in national product be reflected in the improved position of significantly large numbers of individuals, specifically in terms of more and better job opportunities in nonfarm employment. To what extent the Puerto Rican "Operation Bootstrap" has accomplished this objective and what the future prospects are the reader can determine on the basis of a wealth of material on economic changes, population growth, working force changes, industrial and occupational changes, wages and productivity, and school attendance.

In addition to the compilation of this demographic and economic history of Puerto Rico, Jaffe regards as an essential purpose of his study provision of guide lines for other underdeveloped areas on the threshold of economic development. But, as he is forced to point out again and again, Puerto Rico is a special case. Her close connection with the mainland United States has given her many advantages, among them investment capital, social welfare payments and other individual cash benefits, and a home for unlimited numbers of her

[1] Jaffe, A. J.: PEOPLE, JOBS AND ECONOMIC DEVELOPMENT. Glencoe, Illinois, The Free Press, 1959. 381 pp. $6.00.

surplus people. Thus, the grave problem of capital accumulation for economic development in a democracy which must also furnish social services to a growing population if it is to maintain political stability has probably been at a minimum in Puerto Rico. What other underdeveloped areas can learn from the Puerto Rican experience seems to be (1) that they cannot go it alone; (2) they must not fear social and economic change; (3) they must face a task far greater than they at first realized; (4) they cannot expect immediate reductions of unemployment and underemployment; (5) they must therefore be prepared to create some new jobs by government action—school and road building, recreation facilities, etc.; (6) they must encourage private investment, by both domestic and foreign interests; (7) they must be ready for many problems whose solutions call for conflicting programs.

If the author has not fully accomplished the objective of constructing useful guidelines for other areas, he has certainly successfully analyzed what happened to people and to jobs during the years of planned economic development in Puerto Rico. This must be the most complete account of the changing structure of the Puerto Rican population and its labor force. Much of the material consists of hitherto unpublished statistics, some from the sample population survey which the author helped to redesign so that it would better meet the Island's needs. These data, together with those from the various censuses of the area and from current establishment reports, are woven together in a skillful way, to give us our case history.

After several introductory chapters sketching the settlement and recent history of the Island, Jaffe has a chapter on trends in population growth which present measures of fertility, the death rate, rate of natural increase, and net outmigration. The rate of natural increase in the mid-1950's at just under 3 per cent a year would double the population in less than a generation. However, since 1950, population growth has almost ceased, thanks to net outmigration. There is little hope of further improvement in the standard of living if the population is allowed to increase, for the economy is not growing fast enough. For all practical purposes, stability depends upon continued high outmigration; the official effort to promote popu-

lation control through birth control or sterilization programs is far from vigorous.

Developments in employment and unemployment again reflect the beneficent influence of net outmigration. The size of the labor force, particularly the male labor force, has decreased since 1950 and as a result it has not been necessary to stretch the resources of the development program to create substantial numbers of new jobs. Instead, nonagricultural employment has grown by means of a shift of men out of agriculture and a substantial increase in the number of women employed outside the home rather than in home needlework. Hence a major finding of the study: that economic development can take place and national income can increase sharply (i.e., by 50 per cent) without an increase in the number of people at work, if population does not grow. Unemployment has remained about the same, at a rate two to three times that on the mainland. Underemployment in the form of subsistence farming, other marginal self-employment, and part-time work is chronic in Puerto Rico, but has probably decreased slightly over the past decade.

The realignment of the industrial and occupational structure of employment is an interesting story that unfortunately can be traced only in terms of broad groups. Among the industries growing between 1947 and 1956 are first manufacturing, and second government including medical and related services. Transportation, communication, and other public utilities, and other services except domestic have also grown. Construction and trade have fluctuated but on the whole have risen. Agriculture, domestic and personal service, and home needlework, all areas of underemployment, have declined. In terms of occupations, the greatest increases have been in white collar occupations; one-third of the nonagricultural workers in 1955 were in white collar jobs. Jaffe has devised a system of classification of occupations into three groups: *modern* (requiring scientific knowledge or technology or associated with modern business enterprises); *traditional* (not requiring scientific knowledge or the use of machinery, e.g., straw weavers, street peddlers); and *classical* (largely outside of manufacturing and distribution, which do not necessarily involve technology—e.g., clergy-

men, government officials, policemen). Using these classifications within certain standard major census groupings, he finds that employment in "modern occupations" has increased from 9.0 per cent to 12.3 per cent of the nonagricultural total between 1930 and 1955. The comparable percentage for the mainland United States in 1950 was 23 per cent. The largest change in the opposite direction was a drop in traditional occupations among craftsmen and kindred workers from 15.1 per cent to 8.0 per cent. These findings relate only to men.

For various reasons the output per worker in Puerto Rico is still quite low, about one-fifth of the mainland output, but productivity is rising, with the shift of workers from less productive to more productive activities. Even in the traditional industries, sugar cane grinding, cigar making, distilling, however, there have been substantial gains.

One of the most encouraging aspects of the Puerto Rican program is the great emphasis on extending free education to all children. With the high birth rate and the net outmigration of the young adult population, the number of persons 7 to 24 years of age attending school constitutes 26 per cent of the civilian population of the Island. On the mainland, this proportion is only 19 per cent. But if Puerto Rico were to enroll in school as many young people, proportionately, as on the mainland, the government would have to provide education for about 31 per cent of the population—obviously a terrific burden on the economy. Nevertheless, it is largely through raising educational levels that fertility will be reduced and the earnings of the working force increased, the author believes. Not only will the better educated women of the future be able to practice birth control, but they will also tend more often to be members of the labor force, and therefore have fewer children. The demand for trained and educated workers of all kinds is great, while the prospects of shifting the large numbers of uneducated and "undesirable" workers from the marginal jobs to the expanding, higher-paid sectors are virtually zero.

The study concludes with a chapter on Mexico whose economic growth has been at about the same rate as in Puerto Rico, but where the creation of additional jobs has not kept pace with the rapidly growing population. Government pro-

grams, particularly for education, have not been as broad as in Puerto Rico.

An extensive bibliography and several appendixes which bring together some of the author's previously published articles on labor force definition, measurement, and classification add to the usefulness of this timely study.

GERTRUDE BANCROFT

• • •

ELEMENTS OF VITAL STATISTICS[1]

IN 1889, Sir Arthur Newsholme first wrote THE ELEMENTS OF VITAL STATISTICS for "medical officers of health and medical practitioners studying for a diploma in public health." Rewritten in 1899, and again in 1923 when Newsholme lengthened the title to read THE ELEMENTS OF VITAL STATISTICS IN THEIR BEARING ON SOCIAL AND PUBLIC HEALTH PROBLEMS, this book long enjoyed great popularity in the United States as well as in Great Britain. No recent book has been written with the same general approach to the subject matter until publication of ELEMENTS OF VITAL STATISTICS by Bernard Benjamin. As Mr. Benjamin explains in his Preface, he was asked to revise Newsholme's book but found "that developments in the fields of public health and population as well as the statistical methods associated therewith necessitated a complete rewriting of the text." He states further that "Newsholme's teaching of vital and health statistics was based on the narrative account of the available sources of statistics and of their use in every day conditions. . . . I have tried to copy this method."

In this new ELEMENTS OF VITAL STATISTICS, the author gives a concise description of sources of data relating to population, marriages, births, deaths, and disease. Official publications and special reports on these data are cited for both the United States and Great Britain. Considerable attention is given to the errors, limitations, and biases to be looked for in the data,

[1] Benjamin, Bernard: ELEMENTS OF VITAL STATISTICS. London, George Allen and Unwin, Ltd., and Chicago, Quadrangle Books, Inc. ($10.00) 352 pages.

such as inaccurate reporting of age, occupation, etc., under-registration of births and deaths, under-reporting of notifiable diseases, and differences in methods of recording and classifying causes of death. The methods for interpreting demographic and health statistics involve chiefly the use of rates. The various types of rates in common usage are defined and methods of computation and adjustment for factors such as age are described in detail. Included is a brief description of rates developed to measure fertility of populations; gross and net reproduction rates are given for England and Wales in 1954 and the uses of other indices of fertility are illustrated. Life tables are explained and several methods for computing abridged life tables are described. This is the most technical section of the book, but obviously it could not be avoided.

More than half of this book is devoted to morbidity statistics (Chapters 8–19). The data assembled cover a wide range of health problems and the discussion is both interesting and illuminating. Sources of data and methods of analyzing them are described with illustrations from many different studies. The importance of statistical studies and surveys for evaluating public health problems is well demonstrated. Infectious diseases, tuberculosis, cancer, and mental diseases are the subjects of special chapters; and in other chapters, statistics on maternity and child welfare, health of school children, and of industrial groups are reviewed. Potential uses of hospital statistics and of records of general practitioners in the National Health Insurance program for the measurement of sickness experience and of health services are commented on briefly. Finally, there is a short discussion of the problems associated with field surveys.

Although most of the data and nearly all the references to special studies given in this book are for Great Britain, the methods described and the findings relative to the association of various personal characteristics and of social and economic conditions with the risk of death and of disease are equally valid in the United States. Comparability of basic vital statistics in the two countries is given special attention. The book is clearly written and provides a wealth of information on current health statistics and on trends. It is a valuable

reference book for professional health workers and for others interested in understanding statistics in this field.

DOROTHY G. WIEHL

• • •

CONTRACEPTION AND FERTILITY AMONG AMERICAN WOMEN

IN most Western countries the introduction of birth control and the dissemination of contraceptive knowledge have led to a rapid decline, and in some social groups the virtual disappearance, of the large family. As reproduction increasingly becomes a matter for conscious individual choice, the study of population moves further away from biology and becomes a problem for the social sciences. But although demographers have agreed that the declines in Western birth rates were due to deliberate decisions to adopt some method of family limitation, the subject has often been considered too delicate to investigate, and with the exception of the Indianapolis inquiry and the study of family limitation undertaken on behalf of the British Royal Commission on Population, there have been no large-scale studies of unselected groups which aimed to assess the extent of the practice in modern communities. The study by Freedman, Whelpton and Campbell,[1] based on a national probability sample of 2,713 native white married women, aged 18 to 39, is the first attempt to give figures which are valid for the United States as a whole. A long and detailed questionnaire, relating to reproductive behaviour and to ideas and ideals as to family size was administered to these women, and the book consists of an analysis of the replies.

As was to be expected a number of interesting, and to some degree unexpected, results emerge. In the first place, no fewer than one-third of the couples were classified as having some impairment of fecundity, and 10 per cent were definitely sterile, 9 per cent as a result of operations which had a sterilizing effect,

[1] Freedman, Ronald; Whelpton, Pascal K.; and Campbell, Arthur A.: FAMILY PLANNING, STERILITY AND POPULATION GROWTH. New York, McGraw Hill Company, 1959. pp. xix + 515, $9.50.

though this will not always have been the principal reason for the operation. The authors believe, however, that a significant minority of such operations will have been performed for contraceptive purposes, and they are puzzled by the higher incidence of such operations in the lower socio-economic groups. For instance, only 8 per cent of college-educated wives, but as many as 16 per cent of those whose education ended in a grade school had undergone such operations. One cannot help wondering to what extent differences in medical care, both in degree and quality, may have been responsible for this discrepancy. Unfortunately, there are not to my knowledge, any comparable British data, which would show whether similar differences exist under the National Health Service.

The authors estimate that 13 per cent of all pregnancies end in fetal death, and that 25 per cent of the fertile wives will have experienced at least one such death, but unfortunately, they do not discuss socio-economic differentials in the fetal death rate.

The authors continue to discuss the extent to which contraception is used by the women in the sample. They distinguish between those women who used contraception on a motive basis (1,901 couples out of 2,713 had done so at some period in their marriages), and those who used it on an action basis, i.e. women who douched after intercourse, but stated that they did so for hygienic, rather than contraceptive reasons. If the latter group is included the number using contraception rises to 2,207. If attention were restricted to fecund couples, the number of those who have either never attempted to control their fertility, or who have stated their intention not to do so in the future (these are generally couples who have not been married very long) is of the order of only 5 per cent. In other words, among fecund, white American women, birth control is almost universally accepted and used.

However, it also becomes evident that a substantial minority of families do not plan their fertility very effectively. Only 19 per cent of all couples, and 29 per cent of all contracepting couples, were classified as having completely planned families, i.e. pregnancies occurring only at a time when they discontinued contraception. Among contraceptors with four or more

children the proportion of those with at least one unplanned pregnancy was 50 per cent. On the other hand the authors find that voluntary childlessness is now a negligible factor among American married couples.

In view of the large proportion of Roman Catholics in the American population, and the opposition of the Roman Catholic Church to all appliance methods of birth control and to *coitus interruptus*, the behaviour of Roman Catholic couples is of particular interest. The authors find that there exist significant differences between Catholics and Protestants, both in the extent to which they make use of birth control and in the type of contraception used. But they wryly remark that the devout Catholic is more likely to support his religious views with complete non-use if the pressures of family growth are made less urgent by impaired fecundity! Among fecund Catholic couples married for at least ten years, 50 per cent have used a method of birth control other than rhythm. It is fairly clear that pressure of economic circumstances leads Roman Catholics to deviate from the teaching of their Church, as they experience the financial and other problems of a growing family. But an interesting feature among Catholics is the fact that the proportion of Catholic couples who rely on the approved rhythm method only is considerably higher among those who have received a college education than among those of lower educational status. The authors believe that this is accounted for by their greater sophistication and more intense religious motivation. Incidentally, they find that in mixed marriages the attitude of the wife to fertility control is more important as a determinant of reproductive behaviour than that of the husband.

Of the socio-economic differentials influencing reproductive behaviour the authors rate education as being the most important and occupation of husband as least so. On the whole their findings confirm previous suppositions showing a higher proportion of users and of users of appliance methods among couples with a higher socio-economic status.

The next topic discussed relates to the efficiency of different methods of contraception in preventing unwanted births. Unfortunately, no questions were asked about the acceptability

of different kinds of contraceptive methods: in view of the fact that studies have shown that a significant minority of women object to some of the more efficient methods of contraception, on what might broadly be called aesthetic grounds, questions on that topic might have provided useful information.

This brief résumé of some of the principal findings of this section of the book will make it clear that many important new facts about reproductive behaviour have been discovered. This makes it all the more unfortunate that shortage of money prevented the authors from extending their investigations to older married women, so that secular trends could have been studied over a longer period, and to the coloured population. It is to be hoped that the second deficiency will be remedied in the future.

The remainder of the book is devoted to a discussion of expected and desired family size based on answers to questions about these topics, and to an attempt to project population on the basis of the answers given. The principal result obtained is the very considerable agreement, found among all classes of the population, that a family of between two and four children is the ideal size to have. Differential fertility appears to be becoming less important, partly because of a rise in the fertility of women of higher status, particularly those of higher educational status, and partly because of the disappearance of really large families from the lower status groups. The replies to those questions are used to construct estimates of future fertility rates for white women, and the total population of the United States is projected on the assumption that the present differential between white and non-white women will remain constant.

The authors are, of course, aware of the limitations of this technique. Projected rates may be different from those which will ultimately be experienced, and it is likely that both expectations and future behaviour will change under the impact of economic, social, and political changes. Whilst it is obviously sensible to take into account the expectations and views of women at present of childbearing age when assessing their own future fertility, the demographic history of the last thirty years has shown how rapidly and decisively even these views may

change. In particular, the assumption that differentials between the white and Negro population will remain constant strikes me as somewhat rigid and unrealistic, particularly over longer periods. Moreover, the fact that there is general agreement that the ideal family size is between two and four children per married couple still leaves considerable scope for variation. If the two-child family were to regain its popularity, relatively to three or four-child families, the effect on fertility could be quite considerable.

These remarks should not be taken to imply that the standard of the second part of the book is in any way inferior to the first. A study of expectations and values relating to family size is interesting and valuable in itself, whatever its implications may be on the future of fertility rates. To me personally, the first part is of greater interest than the second, but there is no doubt that the book as a whole is a valuable and interesting addition to demographic knowledge. The authors are to be congratulated on the clarity of their exposition and the absence of jargon, and the publishers on the excellence of their printing and layout.

E. GREBENIK

BOOKS

In Collaboration with the Milbank Memorial Fund